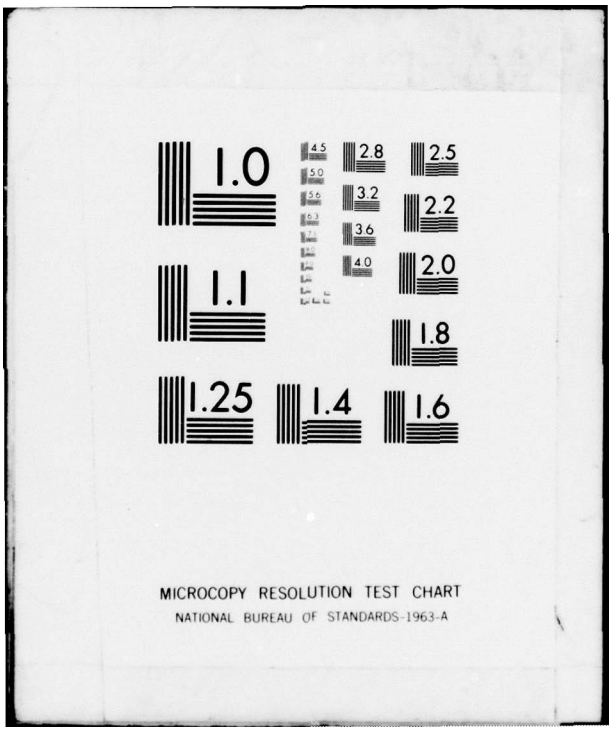
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Rock Island District
Rock Island, Illinois 61201

(6) GREAT II.
Fish and Wildlife Management Work Group
~~Literature, GREAT River Study~~
Annotated Biblography. Volume I.

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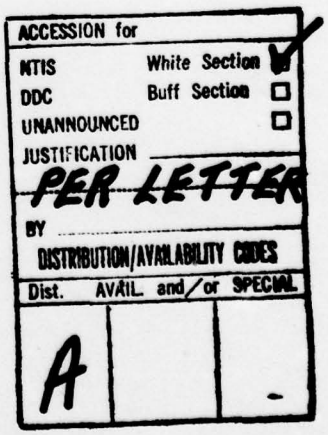
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Contents of Other Volumes

Volume II

Keyword Thesaurus

Biological Keywords
Physical-Chemical Keywords
Geographical Keywords

1.0 Introduction

This bibliography is a compilation of published and unpublished data relating to the fish and wildlife of the Upper Mississippi River from its headwaters to its confluence with the Ohio River. Entries to the bibliography were received in three manners: (1) through computerized bibliographical retrieval systems; (2) through written and/or telephone contact with agencies, universities and individual authors, where the agency, university or author sent Hazleton ES appropriate entries through the mail; and (3) through personal visits to agencies and universities, where Hazleton ES personnel directly retrieved appropriate entries.

Due to the delayed response of some agencies, universities and authors, Hazleton ES will continue to compile appropriate entries from these sources, and will submit an addendum to this report in the same format as the report submitted herein.

2.0 Users Guide

The entire bibliography package is divided into two major sections: I. Bibliography, and II. Keyword Thesaurus.

2.1 Bibliography

The bibliography is subdivided into two sections: (1) an alphabetical listing of all entries authored by individuals; and (2) an alphabetical listing of all entries authored by state and federal agencies, organizations, companies, universities and colleges, and/or other groups (also including those entries listed as anonymous).

In each case the format of the entry is the same. The actual entry information (author, date, title, etc.) is listed first. This is followed by the abstract of the entry, and thirdly, by the keywords which were assigned to each entry for cross-reference purposes.

The following is a typical example of an entry in the bibliography:

JAMES, J.E. 1966. Biology of the soft-shelled turtle, Trionyx sp., of the Upper Mississippi River. M.S. Thesis (education), Winona State College, Winona, MN. 29 p.

Abstract: Trionyx sp. prefers permanent bodies of water large enough to have a slight current, good swimmers, and/or muddy bottoms with sandy beaches. The predators are man who eat turtles, and skunks, raccoons, fox and crows who eat the eggs.

Keywords: Upper Mississippi River, Reptiles, Life history, Research, Survey, Turtles

2.2 Keyword Thesaurus

The Keyword Thesaurus is subdivided into three sections: (1) Biological Keywords, (2) Geographical Keywords, and (3) Physical-Chemical Keywords. Each section contains keywords listed alphabetically. Under each keyword, the author and date of each applicable entry is provided from both the "individual author" bibliography and the "agency" bibliography; and the entries are listed alphabetically under the appropriate subheading of each keyword.

The following is a typical example of a keyword:

I. BIOLOGICAL KEYWORDS

MACROPHYTE

Individual Authors
Eckblad et al. 1977
Quade, Undated
Sefton 1976
Simonet 1978
Smart 1977
Strodthoff 1978

Agencies
NALCO ES 1977b

3.0 Lists of Sources

3.1 Sources Visited Personally

The following is a list of agencies and universities that were personally visited by Hazleton ES personnel to directly retrieve appropriate entries to the bibliography:

Center for Research Libraries, Chicago, Illinois
Illinois Department of Conservation, Aledo, Illinois
Illinois Institute of Technology, Chicago, Illinois
Iowa Conservation Commission, Bellvue, Iowa
Iowa Conservation Commission, Chariton, Iowa
Iowa Institute of Hydraulic Research, Iowa City, Iowa
Iowa State Hygienic Laboratory, Iowa City, Iowa
Minnesota Department of Natural Resources, St. Paul, Minnesota
North Star Research Institute, Minnetonka, Minnesota
Northwestern University, Evanston, Illinois
St. Cloud State College, St. Cloud, Minnesota
St. Mary's College, Winona, Minnesota
U.S. Army Corps of Engineers, Rock Island, Illinois
U.S. Army Corps of Engineers, St. Louis, Missouri
U.S. Army Corps of Engineers, St. Paul, Minnesota
U.S. Fish and Wildlife Service, Rock Island, Illinois
U.S. Fish and Wildlife Service, St. Paul, Minnesota
University of Illinois, Circle Campus, Chicago, Illinois
University of Illinois, Urbana, Illinois
University of Minnesota, St. Paul, Minnesota
University of Wisconsin, La Crosse, Wisconsin
Western Illinois University, Macomb, Illinois
Winona State College, Winona, Minnesota
Wisconsin Department of Natural Resources, Madison, Wisconsin

3.2 Sources Contacted Via Telephone or Mail

The following is a list of agencies and universities which were contacted by telephone and/or letter by Hazleton ES personnel to retrieve appropriate entries to the bibliography by mail. For convenience, this list has been subdivided by state.

Illinois

Commonwealth Edison Company, Chicago, Illinois
U.S. Army Corps of Engineers, Rock Island, Illinois
U.S. Army Corps of Engineers, North Central Division, Chicago, Illinois
Harland, Bartholomew & Associates, Northbrook, Illinois
Illinois Department of Conservation, Carlyle, Illinois
Illinois State Natural History Survey, Urbana, Illinois
Shedd Aquarium, Chicago, Illinois
Southern Illinois University, Carbondale, Illinois

Iowa

Iowa Conservation Commission, Chariton, Iowa
Iowa Conservation Commission, Des Moines, Iowa
Iowa Institute of Hydraulic Research, Iowa City, Iowa
Iowa State Hygienic Laboratory, Iowa City, Iowa
Iowa State University, Ames, Iowa
Loras College, Dubuque, Iowa
Luther College, Decorah, Iowa
D.B. McDonald Research, Inc., Iowa City, Iowa
University of Iowa, Iowa City, Iowa

Minnesota

Mankato State University, Mankato, Minnesota
Minnesota Department of Health, Minneapolis, Minnesota
Minnesota Department of Natural Resources, St. Paul, Minnesota
Minnesota Pollution Control Agency, St. Paul, Minnesota
North Star Research Institute, Minnetonka, Minnesota
Northern States Power Company, Minneapolis, Minnesota
St. Cloud State University, St. Cloud, Minnesota
St. Mary's College, Winona, Minnesota
U.S. Army Corps of Engineers, St. Paul, Minnesota
U.S. Department of Interior, Fish and Wildlife Service, Twin Cities, Minnesota
University of Minnesota, Minneapolis, Minnesota
Upper Mississippi River Wildlife & Fish Refuge, Winona, Minnesota

Missouri

Missouri Department of Conservation, Jefferson City, Missouri
U.S. Army Corps of Engineers, St. Louis, Missouri
University of Missouri, Columbia, Missouri
Washington University, St. Louis, Missouri

Wisconsin

Malacological Consultants, La Crosse, Wisconsin
University of Wisconsin, Eau Claire, Wisconsin
University of Wisconsin, La Crosse, Wisconsin
University of Wisconsin, Milwaukee, Wisconsin
University of Wisconsin, Madison, Wisconsin
U.S. Fish and Wildlife Service, La Crosse, Wisconsin
Wisconsin Department of Natural Resources, Madison, Wisconsin

Other

Auburn University, Auburn, Alabama
Battelle Northwest Pacific Labs, Richland, Washington
Colorado State University, Ft. Collins, Colorado
Columbia University, New York, New York
Drake University, Des Moines, Iowa
Duke University, Durham, North Carolina
Ecological Consultants Inc., Ft. Collins, Colorado
Hanford Engineering Development Lab, Richland, Washington
Ichthyological Associates, Berwick, Pennsylvania
Kent State University, Kent, Ohio
Look Labs, Honolulu, Hawaii
Mississippi State University, Mississippi State, Mississippi
Purdue University, Water Resources Research Center, West Lafayette, Indiana
U.S. Army Corps of Engineers, Vicksburg, Mississippi
U.S. Department of Agriculture, Washington, D.C.
U.S. Department of Health, Education, & Welfare, Washington, D.C.
U.S. Department of Transportation, Washington, D.C.
U.S. Fish & Wildlife Service, Washington, D.C.
University of Michigan, Ann Arbor, Michigan
University of Utah, Salt Lake City, Utah

I. BIBLIOGRAPHY

AUTHORS

ABLES, J. R. Jr., and T. E. MURPHY. 1958. Army Engineer Waterways Experiment Station, Vicksburg, Miss. July 1957 - July 1958.

Abstract: Trial operations of the filling and emptying system of new Lock No. 19 on the Mississippi River at Keokuk, Iowa, revealed severe load pulsations on the culvert valves, which resulted in intermittent reversals in loading on the valve hoist and a consequent clattering in the operating machinery. These pulsations were so severe at large valve openings that it was deemed risky to operate the valves at openings greater than about two-thirds. A 1:12-scale model of one of the reverse-tainter type culvert valves was used to study valve modifications that would eliminate clattering and permit normal operation of the valves.

Keywords: Dam , Lock, Models, Iowa

ABOUEL-NOUR, A. 1970. A system approach for the study and control of factors affecting water pollution. Mississippi State University. Water Resources Research Institute. July 1970. 53 pp.

Abstract: This study was conducted during the fiscal year beginning July 1, 1969, and ending June 30, 1970. The objectives of the research were directed toward testing the feasibility of applying a system approach for the study of pollutants and/or quality factors in a river. The Pearl River and its major tributaries were selected to implement the study.

Preliminary analysis of the Pearl River data suggested treating it by dividing it into reaches. For example, the regression equations of the biochemical oxygen demand (BOD), and dissolved oxygen (DO) for two consecutive reaches (one of them is heavily polluted) underestimate the ultimate degradation in qualities near the significant organic waste source. Seven reaches have been used for the Pearl River and its major tributaries.

Keywords: Models, Water quality, Pollution

ACKERMAN, G. L. 1968a. The art of walleye fishing (Part I). Iowa. Conserv. 27(6).

Abstract: The basics about walleye fishing are discussed. Better fishing is in Pools 9, 10, 11 and 12 from Bellevue

north to Lansing, Iowa. As important as methods or lures is the angler's knowledge of the Mississippi River. Basic knowledge of walleye and sauger habits is extremely important. Jigging and lures are discussed.

Keywords: Walleye, Fishing, Sauger

ACKERMAN, G. L. 1968b. The art of walleye fishing (Part II). Ia. Conserv. 27(7).

Abstract: Different types of walleye fishing are discussed such as still fishing, trolling, and bait casting. Methods to remove snagged lines are also given.

Keywords: Walleye, Fishing

ACKERMAN, G. L. 1974. 1974 Commercial Fishing Statistics. Pool 9-19, Mississippi River. Iowa Cons. Comm. pp. 167-176.

Abstract: Commercial fishing statistics are compiled annually by the Iowa Conservation Commission. This paper reports the commercial catch for 1974 from the Iowa boundary waters of the Mississippi River. Also reported are trends of commercial fish caught over the last decade from all water of the Mississippi River along Iowa.

Keywords: Commercial fishing, Pools 9-19, Iowa

ACKERMAN, G. L. 1975a. Iowa's first snagging season for paddlefish. Ia. Conserv. 34(2):6-9.

Abstract: The Mississippi River system contains the largest concentration of paddlefish in the western hemisphere. They are distinguished by an elongated, paddle shaped snout affixed to a body resembling a pregnant torpedo. The paddlefish is one of the more primitive groups of fish. Snagging is the only method to take paddlefish since they feed by straining minute organisms from the water.

Keywords: Iowa, Paddlefish

ACKERMAN, G. L. 1975b. 1975 Northern Pike Culture-Pools 10 and 11 of Mississippi River and Guttenberg Management Station and Hatchery. Iowa Cons. Comm. pp. 118-122.

Abstract: 1975 was the first year northern pike were hatched at the newly acquired Guttenberg Management Station and Hatchery. Brood northern pike were netted from the Mississippi River near Guttenberg. Fry produced were either stocked in receiving waters as fry or transferred to Decorah hatchery for pond rearing to fingerlings. In addition, 595,000 eyed eggs were transferred to the state of Virginia in trade for striped bass eggs.

Keywords: Fish management, Stocking, Propagation, Pools 10 and 11, Northern pike, Pike

ACKERMAN, G. L. 1975c. Rare and endangered vertebrates of Illinois. Bur. Envir. Sci., Ill. Dept. Trans. 50 pp.

Abstract: Included in this report are annotated lists of rare and endangered vertebrates in Illinois, maps of the presumed ranges of some of these species, county lists of observed locations or rare and endangered species, and other information about their status, ecological habitats, and distributions within the state.

Keywords: Illinois, Rare species, Endangered species.

ACKERMAN, G. L. 1976a. Great River Environmental Action Team (GREAT), Pools 9 through 13 of the Mississippi River. Iowa Cons. Comm. Project No. 76-II-C-30. pp. 152-155.

Abstract: This is the second year of a two year study of the Mississippi River entitled GREAT I. The background, scope, responsibilities, and objectives of GREAT were previously discussed in detail in the 1975 Job Completion Reports, pp. 190-196. The study will be continued if the United States Congress provides further funding.

Keywords: Limnology, Pools 9-13, Management

ACKERMAN, G. L. 1976b. Creel Survey of the Winter Ice Fishery of the Upper Mississippi River, 1976. Upper Mississippi River, Pool 9 through 13. Iowa Cons. Comm. Proj. No. 76-II-31. pp. 156-174.

Abstract: Expandable creel surveys were made on four selected ice fisheries in Pools 9 and 10 of the Mississippi River the winter of 1975-76. Two areas were creeled near Lansing in Pool 9. They were the Big Lake Area and the Winneshiek Bottoms. Two areas were creeled

in Pool 10. They were Bussy Lake near Guttenberg and the Sny Magill Area near McGregor. Objectives were to determine the fishing pressure, success, harvest, and species composition of the catch taken by ice fishermen. Other information collected were species preference, baits utilized and angler domiciles. An evaluation of all ice fisheries on the Upper Mississippi River was made by making random aerial counts of ice fishermen during the winter of 1975-76. Angler counts were made five times monthly throughout the fishing season. Single flights were made from the Iowa/Minnesota border to Lock and Dam 13 at Clinton. The survey included all of Pools 9 through 13 regardless of state, federal or private ownership of the river. Data recorded were the number of anglers fishing and the locations of the ice fisheries. Our basic objectives were to map, identify and record these ice fisheries. Angler counts were expanded and incorporated with the four specific creel surveys to determine fishing pressure, harvest and economic value of the total ice fishery in Pools 9 through 13.

Keywords: Creel census, Pools 9-13, Ice, Harvest

ACKERMAN, G. L. 1976c. Commercial Fishing Statistics. Mississippi River, Pools 9 through 19 and Missouri River. Iowa Cons. Comm. Proj. No. 76-II-C-33. pp. 179-189.

Abstract: Commerical fishing statistics are compiled annually by the Iowa Conservation Commission. This paper reports the 1975 commercial fish harvest from the Mississippi and Missouri Rivers bordering Iowa.

Keywords: Commerical fishing, Survey, Pools 9-19, Iowa

ACKERMAN, G. L. 1976d. 1976 Northern Pike Culture. Mississippi River - Pools 10 and 11. Iowa Cons. Comm. Proj. No. 76-II-C-34. pp. 190-195.

Abstract: 1976 was the second year northern pike fry were cultured at the Upper Mississippi River Fishery Management Station at Guttenberg. A new well was installed which supplies 240 gpm of water at a constant 53 F temperature. One additional incubator was installed to increase capacity to 136 jars for incubatiton of 18 million eggs. Fry production ranges between 4.5 and 5.5 million northern pike fry at an expected survival rate of 25 to 30 percent. Brood northern pike are netted with trap nets in Pools 10 and 11 with approximately 2,500 brood fish required for cultural operations.

Keywords: Stocking, Propagation, Fish management, Pools 10 and 11, Northern pike, Pike

ACKERMAN, G. L. 1976e. Survey of Freshwater Mussels of the Upper Mississippi River, Pools 9 through 13. Iowa Cons. Comm. Proj. No. 76-II-C-35. pp. 196-200.

Abstract: The project objectives are: 1) to determine the species of clams present in the Mississippi River, 2) map the known clam beds, 3) collect statistics on the commercial harvest of clams in Iowa waters and 4) determine the abundance and length frequencies of each species that comprise the commerical catch.

Keywords: Clams, Survey, Distribution, Harvest, Abundance, Mussels, Pools 9-13, Length frequency

ACKERMAN, G. L. 1976f. Clamming the Mississippi River. Iowa Conservationist. 35(9) 3 p.

Abstract: General description of the history of clamming as a business and description of the clams of Iowa. Clamming methods used today are presented.

Keywords: Clams, Benthos, Iowa, Methods, Equipment

ACKERMAN, G. L. 1977. Water Level Management of the Mississippi River. Iowa Cons. Comm. Proj. No. 77-II-C-17. pp. 114-119.

Abstract: Objectives:

1. Monitor the pool water stages at Lock and Dam 10 for one year and communicate to the St. Paul District Office of the U.S. Army Corps of Engineers any problems that arise.

2. Communicate and promote water level management as an integal part of GREAT I and II management plans for the Mississippi River.

Keywords: Lock and Dam 10, Flow, Water diversion, Lock, Dam

ACKERMAN, G. L., P. E. KOEHN and B. J. PERSEN. 1977. Prealteration Study of the Fishery and Morphology of Cassville Slough. Pool 11, River Mile 608.6 to 615.1. Iowa Cons. Comm. Proj. No. 77-II-C-15. pp. 99-108.

Abstract: This pre-alternation study is designed to determine the amount of habitat degradation that has occurred in Cassville Slough since 1938 and to determine baseline fisheries and physical parameters to be compared to a future post-alteration study. The results of the two studies will determine the effects of closing side channels on fisheries habitat and populations.

Keyword: Habitat, Management, Fish, Pool 11, Fish habitat, Fish population

AITKEN, W. W. 1936. Some common Iowa Fishes. Iowa State College. Ext. Cir., 224:1-33. Ames.

Abstract: This publication gives a simplified description of each fish by calling attention to outstanding characters. Also discussed are range, food habits and reproduction.

Keywords: Fish, Iowa

AITKEN, W. W. 1941. A preliminary report on a check-list of Iowa teleosts. Proc. Iowa Acad. Sci., 47(1940):387-392.

Abstract: This article includes a list of native fishes known from Iowa and a hypothetical list of fishes which may be discovered in Iowa.

Keywords: Fish, Iowa

ALBRIGHT, G. H. and K. J. WRIGHT. 1973. Mississippi river Special Tailwater Sport fish creel census in Pool 7, March 1 - April 30, 1973. Manage. Rpt. No. 64 Bur. Fish Manage. W. Central Div. Wis. Dept. Nat. Res.

Abstract: A creel census was conducted in the tailwaters of Pool 7 from March 1 to April 30, 1973 to evaluate the fishing pressure and harvest during a two-month period previously closed to fishing for large game fish. The 1973 special tailwater creel census survey was conducted under the auspices of the Fish Technical Section of the Upper Mississippi River Conservation Committee as part of a plan to maintian a continuing evaluation of the sport fishery.

The 1973 census concludes a series of similar surveys which began in 1969. Accordingly, a managment report summarizing the results of the entire series will follow this report at a later date.

Keywords: Creel census, Fish, Pool 7, Harvest

ALBRIGHT, G. H. and K. J. WRIGHT. 1975. Mississippi River special fall tailwater sport fishing creel census, Pools 7, 8, and 9, October 1, 1972 - November 30, 1972. Wis. Dept. Nat. Res. Fish Manage. Rept. No. 77. 56 pp.

Abstract: Results of a special creel census describing types of fish caught and where, gear used, hours of fishing per fisherman, and number of fish caught per hour.

Keywords: Creel census, Pools 7, 8, 9, Tailwater, Sport fishing

ALEXANDER, M. L. 1915. More about the paddlefish. Trans. Am. Fish. Soc. 45(1):34-39.

Abstract: These studies were carried out in White Lake, La. during March 1915 with a view to obtaining more knowledge of the spawning season and habits of this fish. Possible rearing in retaining ponds was explored during this season.

Keywords: Fish, Paddlefish

ALFORD, A. L. 1974. Environmental Application of Advanced Instrumental Analyses: Assistance Projects FY 73. Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab. Office of Water Research and Technology, Washington, D.C.

Abstract: The National Water Contaminants Characterization Research Program (now the Analytical Chemistry Branch) of the Southeast Environmental Research Laboratory identified and measured aquatic pollutants under eight projects in answer to requests for assistance. In most cases these analyses helped to solve, or at least to understand more clearly the related pollution incident and in some cases provided evidence for enforcement of regulatory legislation. The cases briefly reported include: Terpenes in paper mill effluents and Mississippi River samples; organic compounds formed during chlorination of municipal waste sludge; organic components of dye plant effluents; organic compounds formed during chlorination of municipal waste sludge; organic components of dye plant effluent; organic and elemental components of coal-gasification pilot plant effluent; elemental analysis of Lake Ontario water; elemental analysis of patio debris; and elemental analysis of mineral processing plant wastes.

Keywords: Water quality, Pollution, Effluent, Research

ALLEN, C. W. 1970. Acanthocephalan infestation of various bottom feeding fish in Pool No. 6 of Mississippi River. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: This study was carried out on Pool VI of the Upper Mississippi River to determine the effect of the intestinal parasite, Acanthocephala, on the coefficient of condition in the fish. The specimens were collected randomly throughout the area. The species involved were: sheepshead, Aplodinotus grunniens; channel catfish, Ictalurus punctatus; spotted sucker, Minytrema melanops; flathead catfish, Pilodictus olivaris; silver redhorse, Mexostoma anisurum; and the brown bullhead, Ictalurus nebulosis.

The results of the study indicated that only Minytrema melanops, Ictalurus punctatus and Aplodinotus grunniens were infected with the parasite. The total infestation was 10% of the 406 fish captured and it is indicated that each species is affected differently. The infestation ranged from 43 to 1 per infested individual and the parasite doesn't seem to affect the coefficient of condition of the infested fish.

Keywords: Fish, Disease, Pool 6, Parasites, Condition

ALLEN, F. R. and A. W. GARRISON. 1972. Gas chromatography, mass spectrography identification of organic acids in the Mississippi River. Bull. Ga. Acad. Sci. 30(2):69.

Abstract: Identification of pollutants in the Mississippi River was necessary to assess the significance of organics entering the river via a municipal waste effluent. Organics from river samples taken at three locations near Burlington, Iowa, were collected on activated carbon. Chloroform extracts of the three samples were separated into acid, base, and neutral fractions. The acid fractions were esterified with diazomethane and chromatographed on an SE-30 SCOT column yielding identical chromatograms. The combined acid fractions were examined in detail by GC/MS (magnetic focusing). Fifteen long-chain acids (methyl esters) were tentatively identified by their mass spectrometric fragmentation patterns. These included the saturated straight-chain isomers corresponding to each carbon number from 7 to 16, saturated branched-chain isomers of C_9, C_{13}, C_{14}, and C_{15}, and a monounsaturated C_{16}

acid. Ozonolysis confirmed the C_{16} unsaturated acid and showed the presence of two other unsaturated acids. Use of a computer-controlled quadrupole mass spectrometer to scan the GC effluent at m/e settings of 74 and 87 confirmed the presence of all previously identified acids (methyl esters).

Keywords: Pollution, Water quality, Methods

ALLEN, J. L. and J. B. HUNN. 1975. Renal excretion in Coho salmon (Oncorhynchus kisutch) after acute exposure to 3-trifluoromethyl-4-nitrophenol. J. Fish. Res. Board Can. 32(10):1873-1876.

Abstract: Coho salmon (Oncorhynchus kisutch) exposed to an acute, sublethal concentration of 3-trifluoromethyl-4-nitrophenol (TMF) exhibited an increased output of urine when compared with controls, but the urinary excretion of Na, K, Ca, Mg, and Cl was not affected. About 35 times more conjugated TFM then free TFM was excreted during the 24 hr. study period.

Keywords: Sport fishing, Pollution, Toxicant, Fish, Fish management, Chlorinated hydrocarbons, Pesticide, Water quality, Research, Physiology

ANDERSEN, M. L. 1976. Causes of decreased migrant waterfowl use in part of the Upper Mississippi River Wildlife and Fish Refuge. M.S. Thesis. Univ. of Wisconsin, Stevens Point. 63 p.

Abstract: This study was designed to determine the causes for decreased migrant waterfowl use in the Weaver Bottoms of Mississippi River pool five. Spring Slough, in pool seven, was selected as a control

Vegetation was sampled on square foot plots. The species present and their respective abundances were determined.

Vegetation type maps and waterfowl censuses made during this study were compared to those made at intervals since impoundment created this habitat in the late 1930's.

Lessened waterfowl use was due to a pronounced decrease in the abundance of aquatic macrophytes which supplied food for waterfowl.

Keywords: Waterfowl, Migration, Upper Mississippi River Wildlife and Fish Refuge, Pools 5 and 7

ANDERSON, H. G. 1959. Food habits in migratory ducks in Illinois. Ill. Nat. Hist. Surv. Bull. 27(4):289-344.

Abstract: This investigation was initiated because of the small amount of research done on the food habits of ducks using Illinois as a stopover on their migration flights. For the study duck gizzards were collected along the Illinois River and the Mississippi River and analyzed in the lab.

Keywords: Migration, Ducks, Illinois, Food habits

ANDERSON, R. A. 1972. Food habits, length-weight relations, and conditions of the Shorthead Redhorse (Moxostoma macrolepidoteum Lesueur) and the Carp (Cyprinus carpio L.) collected from the Mississippi River near Monticello, Minnesota. M.S. Thesis, St. Cloud State Univ., St. Cloud, MN. 111 p.

Abstract: From July 1971 to June 1972, 131 shorthead redhorses and 100 carps were collected from a six mile stretch near Monticello. Shortheads fed in amounts with short even pulses while carp fed throughout eight hours, but primarily early morning and late evening. Shortheads greater than 150 mm food was 96% immature insects while those shorter than 50 mm ate Difflugia, Copepoda, Cladocera, muds and diatoms. Algae was 55% of total annual food volume for carps especially July through October. Both fish consumed largest amounts in summer and fall and each occupied separate niches.

Keywords: Fish, Food habits, Length-weight, Condition, Minnesota, Carp, Shorthead redhorse

ANDING, M. G. 1965. Hydraulic analysis of Mississippi River channels, miles 373 to 603, fiscal year 1964. Potam. Invest. No. 19-1. U.S. Army Engr., Waterways Exp. Sta. Vicksburg, Miss.

Abstract: This report presents a description of field and office investigations of selected cross sections and reaches of the Lower Mississippi River made through FY 1964 as a part of the general potamology investigations for improving techniques for stabilizing the bed and banks of the Mississippi River. The general purpose of the in-

vestigations being conducted under Potamology Research Project 10 is to analyze the hydraulic elements of the Mississippi River cross sections and establish allowable limits of area-depth and width-depth variations and determine the relations of radii of curvature to widths and depths, all in relatively stable reaches of the river. Using these elements and factors as a guide, criteria can be developed for proper alignment through bends, desirable widths, depths, and lengths of crossings, and satisfactory control and alignment of relatively straight reaches.

Keywords: Channelization, Hydrology

ANDING, M. G. 1970. Hydraulic characteristics of Mississippi River channels. Interim Rept. FY 70. Potam. Invest. No. 19-3. U.S. Army engr, Waterways Exp. Sta. Vicksburg, Miss.

Abstract: The project consists of field and office studies of extensive river reaches comprising all types of channels and cross sections. The purpose of the project is to develop criteria for the proper curvature of bends, determine proper lengths, widths, and depths of crossings, and to establish the optimum alignment and configuration of river channels in bends, crossings, and straight reaches. Other objectives include: first, determination of the more important hydraulic variables, including sediment transport, and their interrelations; second, development of criteria for the design of river control structures; and third, determination of procedures for evaluating the effect of existing and proposed river training structures.

Keywords: Channelization, Hydrology

APPELGET, J. G. 1951. Age and rate of growth of the channel catfish (Ictalurus lacustris punctatus) as determined by use of the vertebrae. M.S. Thesis, Univ. of Minn. 63 pp.

Abstract: Application of age and rate of growth data to fishery management problems has its limitations, and reaches its maximum usefulness only when combined with data on mortality and replacement. If subsequent investigations into the life history and management of channel catfish reveal that a more adequate spawning stock is necessary to maintain the fishery, such an increase could be effected by raising minimum size limit. The present minimum size limit of 12 inches total length

permits taking of female fish before they have reached maturity. A 14-inch minimum size limit would allow about one-third of the females to reach maturity before entering the fishery.

Keywords: Age and growth, Fish, Life history, Fish management, Size limit

APPLEGET, J. G. and L. L. SMITH, JR. 1950. The determination of age and growth from vertehbrae of the channel catfish, Ictalurus lacustris lacustris. Trans. Amer. Fish. Soc., 80:119-139.

Abstract: Age and rate-of-growth calculations were made form the fifth vertebrae of 535 channel catfish (Ictalurus lacustris punctatus) taken from Pool 9 of the Upper Mississippi River at Lansing, Iowa. Vertebrae were collected during the summers of 1945 and 1946 and examined with the aid of a standard scale projector. They were prepared by removal of adhering material with a solution of pepsin and hydrochloric acid. Direct observation of the centra of the vertebrae revealed annular rings which were shown to be true year marks when checked by the usual tests of validity. In addition field samples were compared to fish of known age. Body-vertebra relationship was shown to be curvilinear and appropriate corrections were made in all calculations. Growth of catfish is slow throughout life and progresses at a uniform rate for a longer period than is characterisitic of most fresh-water fishes. Growth is greatest during the second year of life and Lee's phenomenon is not apparent in calculations based on older fish. Growth increment in succeeding calandar years varied greatly but trends showed a striking resemblance to those of fresh-water drum taken from the same water during the same period. A few catfish mature at a length of 12 inches but 100 percent of the fish are not mature until a length of 22 inches is attained. Sex ratio was 1.12 males to one female.

Keywords: Paleoichthyology, Age and growth, Life history, Fish, Channel catfish

ARNER, D. H., G. A. ANDING, W. A. LUNCEFORE, and C. SUMMEROUR. 1972. Ecological and recreational use survey of Luxapalila River. Water Resources Bull. 8(2):367-377.

Abstract: An ecological and recreational use survey was made of the Luxapalila River in Mississippi. This study was

made before channelization work was started by the Army Corps of Engineers. A follow-up study is planned after channelization work is completed.

Four stations were located along a 10.5 mile stretch of river where certain chemical and biological measurements were taken during the four seasons of the year.

The results of this study revealed that the river is an unpolluted biologically productive waterway relatively high in chemical constituents. Eleven families and 37 different species of fish were collected. Biomass measurements of standing crops of invertebrates ranged from a low of 0.11 grams oven dry weight per square meter to a high of 18.89 grams per square meter, with larger biomass collected from eddy areas than from riffle areas.

A survey of recreational use of the river indicated relatively light use was made of the river. Fishing was the major use followed by swimming.

Keywords: Channelization, Water quality, Recreation, Biomass, Fish, Fishing, Sport fishing, Luxapalila River

ARNOLD, B. 1973. Barge traffic crowds inland waters as the business booms. Wall Street J. April 13, 1973. p. 1

Abstract: River shipping is booming because of a demand for inexpensive ways of moving bulky cargos. The economic recovery of last year is credited with part of the boom along with river improvements of locks and dams.

Keywords: Water quality, Pollution, Dam, Urbanization, Commercial boat traffic, Ohio River

ARTHUR, G. C. and D. D. KENNEDY. 1972. Illinois waterfowl survey-permanent site waterfowl trap. Ill. Dept. Cons. W-043-R-20/SP1. 8 p.

Abstract: Faced with knowledge that levels in the Mississippi Valley succumbed to spring overflow and that dams in the mid-atlantic states are still showing cracks and ups from last summer's tropical storm Agnes, new forces have joined conservationists in the morning debate over the nations multibillion dollar flood control program.

Keywords: Illinois, Survey, Waterfowl, Trapping

ASHTON, G. D. 1974. Evaluation of Ice Management Problems Associated with Operation of a Mechanical Ice Cutter on the Mississippi River. Cold Regions Research and Engineering Lab, Hanover, NH. Coast Guard, Washington, D.C.

Abstract: Ice management problems associated with operation of a mechanical ice cutter for use in icebreaking as an aid to winter navigation are examined. The study concentrates on effects occurring after the cutting operation. Included in evaluation are assessments of refreezing rates, movement and disposition of the slabs produced by the cutting, and an examination of effects related to ice jams. The evaluation is specific to the Upper Mississippi River, in particular Pool 19 above Lock and Dam 19 at Keokuk, Iowa. It was found that most ice production during a winter occurs during a small fraction of the period of ice cover; hence removal after these short periods may allow navigation to proceed for siginificant wintertime periods.

Keywords: Iowa, Navigation, Commerical boat traffic, Upper Mississippi River, Pool 19, Dam, Lock, Lock and Dam 19

ASHTON, G. D., S. L. DENHARTOG, and B. HANAMOTO. 1973. Icebreaking by tow on the Mississippi River. Cold Regions Res. and Eng. Lab. Hanover, N.H. 77 p.

Abstract: A field investigation of icebreaking by the motor vessel Renee G. operating on the Mississippi River between Alton, IL and Fort Madison, IA is reported. The operation encountered a wide variety of barge configurations and arrangements. Important qualitative observations of the nature and difficulties encountered while icebreaking were made; and, by instrumenting the propeller shafts and using load cells between the towboat and the barge, quantitative information was obtained on the resistance encountered while icebreaking. Also described are the effects of repeated passage through the ice cover, navigation procedures peculiar to icebreaking, and minor damage sustained by the towboat.

Keywords: Tow, Commerical boat traffic, Illinois, Iowa, Navigation

AYRES, B. D. JR. 1973. Flood Experts Call for Curbs on Development in Low-Lying Areas. New York Times May 27, 1973. Sec. 1. p. 40.

Abstract: Faced with knowledge that levees in the Mississippi Valley succumbed to spring overflow and that dams in

the mid-Atlantic states are still showing cracks and rips from last summer's tropical storm Agnes, new forces have joined conservationists in the running debate over the nations multibillion dollar flood control program.

Keywords: Flood, Flooding, Dam, Development, River lowland

BAHR, D. M. 1977. Homing, swimming behavior, range activity patterns and reactions to increasing water levels of walleyes (Stizostedion vitreum vitreum) as determined by radiotelemetry in navigational pool No. 7 and 8 of the Upper Mississippi River during spring 1976. M.S. Thesis, Univ. Wisc., La Crosse, WI.

Abstract: To determine the effects of navigation pool on nutrient dynamics of river, water samples were collected from 4 sites, twice a month from March 12 to October 1, 1972. pH, temperature, nitrate and phosphate were determined. Filtered samples were innoculated with predetermined quantity of Scenedesmus quadricula and Chlorella vulgaris and known volume of $NaHC^{14}O_3$.

Keywords: Fish, Behavior, Pools 7 and 8

BAILEY, R. M. 1960. A list of common and scientific names of fishes from the United States and Canada. Am. Fish. Soc. Spec. Publ. No. 2. 102 pp.

Abstract: This second list of the names of fishes of the United States and Canada is not simply a reprinting with corrections, but constitutes a major revision and enlargement. This present list covers all fish species from the fresh waters of coastal U.S. and Canada to a depth of 100 fathoms. Common names, areas of occurrence and some ecology is listed under each species.

Keywords: Fish, Species list

BAILEY, R. and F. CROSS. 1954. River sturgeon of the American genus, Scaphirhynchus: characteristics, distribution, and synonomy. Pap. Mich. Acad. Sci. Arts Lett. 39(II):169-208 (Zoology).

Abstract: Among the many endemic genera of North American freshwater fishes, one of the most distinctive and bizarre is Scaphirhynchus, which includes two species confined to the larger rivers of the interior lowlands, primarily in the Mississippi basin. S. platorynchus (Rafinesque) is the more common and widely distributed species and is the subject of considerable commerical exploitation. S. album (Forbes and Richardson) was not described until 1905 and remains one of the least known of our larger freshwater fishes. Originally taken near the mouth of the Illinois River, it has since been reported definitely only from the mouth of the Missouri River and from the Mississippi River at Keokuk, Iowa. The recent accumu-

lation of new material of both forms enables us to verify their specific, though not generic, distinctness, present descriptive measurements and meristic counts, contrast the species in certain differential characters, list new records of specimens, and map the known geographic ranges.

Keywords: Fish, Distribution, Life history, Sturgeon

BAILEY, R. M. and H. HARRISON, JR. 1943. Food habits of channel cats reveal interesting facts. Iowa Conserv. 2:57-64.

Abstract: As part of a contemplated life history study of the channel catfish, the food habit interrelations were studied. Size of the catfish played a more important role than seasonal variation in the selection of food eaten. Catfish less than four inches long fed almost exclusively on aquatic insect larvae. Catfish over this size added plant material and small fish to their diet.

Keywords: Fish, Food habits, Channel catfish, Catfish

BAKER, F. C. 1903. Shell collecting on the Mississippi (Savanna, Illinois). Nautilus 16:102-105.

Abstract: List of species collected near Savanna, Illinois.

Keywords: Clams, Mussels, Benthos, Illinois

BAKER, F. C. 1905. The molluscan fauna of McGregor, Iowa. Trans. Acad. Sci. St. Louis. 15:249-256.

Abstract: Catalog of species found in the Mississippi River near McGregor, Iowa. The frequency of their occurrence was stated and also how many of each species contained pearls. Distortions of valves were also described.

Keywords: Benthos, Mussels, Iowa

BAKER, F. C. 1906. A catalogue of the mollusca of Illinois. Ill. State Lab. Nat. Hist. Bull. 7(6):53-136.

Abstract: Catalogue attempts to record every reference to the Mollusca occurring in the State which may be found in the few published lists, and also all scattered references to the same, wherever published.

Keywords: Benthos, Mussels, Illinois

BAKER, F. C. 1928a. The fresh water Mollusca of Wisconsin, Part I, Gastropoda. Bull. Wis. Geol. Nat. Hist. Surv. No. 70. p. 1-309.

Abstract: Taxonomic key with detailed descriptions of mussels and ecological information.

Keywords: Mussels, Benthos, Wisconsin, Taxonomy, Keys

BAKER, F. C. 1928b. The fresh water Mollusca of Wisconsin, Part II, Pelecypoda. Bull. Wis. Geol. Nat. Hist. Surv. No. 70. P. 310-495.

Abstract: Taxonomic key with detailed descriptions of mussels and ecological information.

Keywords: Benthos, Wisconsin, Taxonomy, Mussels, Keys

BALDWIN, R. E. 1970. Palatability of three species of fish and aroma of water from sites on the Mississippi River. J. Food Sci. 35:413-417.

Abstract: Since the commercial fishery on the Mississippi River has been declining, an attempt was made to assess the the palatability of fish from selected sites above and below the entry of effluent from St. Louis. Also, the relationship between palatability of fish and aroma of water was studied. Carp, flathead catfish, freshwater drum and water were sampled from 5 sites on the Mississippi River. Summer, fall and spring quarters collected fish samples which changed in palatability and varying water odors.

Keywords: Fish, Pollution, Palatability

BALDWIN, R. E., K. G. SIDES and J. W. ROBINSON. 1969. Relationship of size and body area to the flavor and aroma of fish. Trans. Am. Fish. Soc. 98(3):533-537.

Abstract: The purpose of this research was to determine whether there are differences in flavor or aroma from one position to another in the edible flesh among different weight specimens of three species of fishes.

Keywords: Fish, Palatability

BALDWIN, R. E., D. H. STRONG and J. H. TORRIE. 1961. Flavor and aroma of fish taken from four freshwater sources. Trans. Am. Fish. Soc. 90(2):175-180.

Abstract: Taste-panel studies were conducted on fish taken from four freshwater sources which included a cold deep lake, a shallow mixed water lake, and flowages above and below the entry of effluent from industrial plants. Fish were sampled at four seasons of the year. Taste-panel members rated the fish as to acceptability and described any unusual flavor or aroma noted. Statistical treatment of the data demonstrated that walleye (Stizostedion vitreum vitreum) taken from the source below the entry of effluent from industrial plants generally scored significantly lower than those from other sources. This trend was not as pronounced for carp (Cyprinus carpio) or for northern pike (Esox lucius). A predominance of undesirable descriptive terms was evident for the fish representing the lowerscoring source.

Keywords: Fish

BANGHAM, R. V. 1944. Parasites of northern Wisconsin fish. Trans. Wis. Acad. Sci. Arts Lett., 36:291-325.

Abstract: The data presented are the result of a fish parasite survey carried on during the spring and summer of 1943 as a joint project between the University of Wisconsin and the Biology Division of the Wisconsin Department of Conservation.

Fish were obtained from over forty different locations, chiefly lakes. The parasites of 1,330 fish belonging to 38 different species are included in this report. These fish were obtained by several methods: by hook and line fishing, from gill and fyke nets, by seining, and by the use of minnow traps. Twelve hundred and thirty-nine, or 93.2 percent of these fish carried at least one species of parasite.

Keywords: Fish, Life history, Disease, Wisconsin, Parasites

BARELS, B. L. 1976. Fish populations of the Mississippi River near Becker, Minnesota. M.S. Thesis, St. Cloud State Univ., St. Cloud, MN. 59 p.

Abstract: Fish were electroshocked over a 3.6 km stretch of the Mississippi River at Becker, Minnesota during 1975. Over 3900 fish were collected. Species composition,

numbers and habitat preference were determined. Shorthead redhorse was most frequent recaptured species. Carp was the largest in biomass.

Keywords: Fish, Shorthead redhorse, Biomass, Survey, Minnesota, Carp

BARKER, H. W. 1940. Sheepshead - drum fish. Wis. Cons. Bull. 5(3):58-59.

Abstract: The sheepshead is a native fish of the north temperate zone of North America. It has a white to cream belly, according to age, blending into an upper coloration of battleship gray, becoming a decided brownish color as the fish ages and increases in size. Its dorsal and pectoral fins, from infancy, are protectively spined with needle points that have exceptional penetrating power.

It is evident that at one time sheepshead abounded in Green Bay, but they are no longer a commercial item. But above the lower Fox river dams, in Lake Winnebago, Buttes des Morts, Poygan and the Fox and Wolf rivers, we have land-locked sheepshead by the ton.

All further observations recorded here are confined to the feeding and breeding habits of this species and the purpose is to record such observations so that others may add pertinent facts to establish a basis of study on the habits of these fish. Minnows, worms, lake flies, crawfish, clams and most forms of water life that appeals generally to the carniverous species are consumed.

Keywords: Fish, Sheepshead

BARNICKOL, P. G. and W. C. STARRETT. 1951. Commercial and sport fishes of the Mississippi River between Caruthersville, Missouri and Dubuque, Iowa. Nat. Hist. Surv. Bull. 25(5):267-350.

Abstract: A survey of the fishes occuring in the Mississippi River between Caruthersville, Missouri, and Dubuque, Iowa, was made in 1944 and 1946. Thirty-one sampling stations were used. The following types of commercial fishing gear wre employed: 25-foot Common Sense minnow seines, 100-yard trammel nets, 100-yard seines, hoop nets, wing nets, trap nets, basket traps, and trotlines. The length and weights of fishes and the conditions

of their gonads were recorded. Characteristics of the Mississippi River and the sampling stations were studied.

Keywords: Commercial fishing, Sport fishing, Missouri, Iowa

BARRETT, K., D. KRICKL, and L. LARSON. 1975. A study of the effect of the Winona Water Pollution Control Plant on the Mississippi River from April - May 1974. B.S. Thesis, St. Mary's College, Winona, MN.

Abstract: Physical and chemical parameters of the Mississippi River, in the proximity of the Winona Water Pollution Control Plant, were monitored monthly from April 1974 to October 1974, to determine if the Winona Water Pollution Control Plant's effluent was having a deleterious effect on the river.

Keywords: Survey, Pollution, Thermal effluent, Chemistry, Discharge, Water quality

BARTEL. SR. B. AND SR. M. C. HOLTKAMP. 1973. Qualitative and quantitative analysis of net plankton of lake Winona. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: Because of the decreasing quality of the water of Lake Winona, a qualitative and quantitative study of the net plankton of this lake was undertaken. It was hoped that such a study would add insights into ecosystem dynamics operating in the lake.

Six collections of net plankton were made at each of the seven stations on Lake Winona between the dates of July 6 and July 25, 1972. Plankton samples were collected by concentrating 10 liters of water.

Keywords: Plankton, Lake Winona

BARTLETT, S. P. 1910. Rescue work - the saving of fish from overflowed lands. Trans. Am. Fish. Soc. 40:153-158.

Abstract: Discussion of state workers transferring fish out of temporary ponds formed during flooding back to the river when the ponds dry up. One instance saw 7000 pounds of fish saved.

Keywords: Fish, Flooding, Rescue

BASCH, P. F. 1963. A review of the recent freshwater limpet snails of North America (Mollusca: Pulmonata). Bul. Mus. Comp. Zool., Harvard Univ. 129:399-461.

Abstract: Museum material was used for a comprehensive study of shells and also in some cases for extraction and preparation of radulae from the fried specimens. Discussion is then given to their ecology, biotic factors and life history.

Keywords: Benthos, Snails

BAUR, R. J. 1967. A survey of the total coliform density in Pool 6 of the Mississippi River for fall and winter seasons. B.A. Thesis, St. Mary's College, Winona, MN. 33 p.

Abstract: This research on Pool 6 of the Mississippi River dealt with a quantification survey of the total coliform densities at certain sampling points during the fall of 1966 and winter of 1967.

Keywords: Bacteria, Pool 6, Survey

BEAN, T. H. 1880. Description of a new species of Amiurus (A. ponderosus) from the Mississippi River. Proc. U.S. Nat. Mus. (1879) 2:286-290.

Abstract: A catfish which weighed 150 pounds was received at the U.S. National Museum. The most distinguishing character of this species is its many - rayed anal, in which it resembles Ichtaelurus rather than Amiurus, though it has the skull-structure of the latter. A description is given of the length, radial formula, and color of the fish.

Keywords: Fish, Catfish

BEASLEY, T. W., B. F. WHITMAN, and W. PELON. 1977. Reversion of histidine-dependent mutant strains of Salmonella typhimurium by Mississippi River water samples. Louisiana State Univ., Medical Center, Dept. of Tropical Medicine and Medical Parasitology. New Orleans, LA.

Abstract: Fifty-three unconcentrated samples of Mississippi River water, collected at six different sites over a nine-month period, were examined with histidine dependent mutant strains of Salmonella typhimurium for the

presence of mutagens and potential carcinogens. Maximum numbers of samples producing reversion were collected during the late summer and autumn months. A correlation between increased river flow and the reduction in the number of samples producing genetic changes was noted.

Keywords: Pollution, Water quality, Disease, Life history, Physiology, Research, Bacteria

BECKER, G. C. 1966. Fishes of the southwestern Wisconsin. Wis. Acad. Sci. Arts Lett. 55:87-117.

Abstract: This is the first published survey of the southwestern fishes of Wisconsin since C. Willard Green published results of his late 1920's survey in 1935. This survey includes other rivers besides the Mississippi.

Keywords: Fish, Wisconsin, Distribution

BEER, L. P. and W. P. PIPES. 1968. A practical approach to the preservation of the environment, the effects of discharge of condenser water into the Mississippi River. Prepared for Commonwealth Edison Company, Chicago, Illinois, by Environmental Science Division, Chicago and Northwestern Univ.

Abstract: The purpose of this study is to observe, in as practical a manner as possible, the effects of condenser waters and therefore heat on the aquatic environment of Pools 14 and 15 of the Mississippi River. These observations are then used as a basis for recommendation of the most efficient and economical design for a proposed nuclear power plant to be located at Cordova, Illinois, that will assure the adequate preservation of the biological and chemical environment.

Keywords: Thermal effluent, Nuclear power, Limnology, Habitat alteration, Pools 14 and 15

BEILKE, L. 1962. The commercial development of the Upper Mississippi River through 1961. A research paper presented to the graduate council, Winona State College. 114 p.

Abstract: One of the major contributions of the river to the rapid development of the Mississippi Valley region and beyond was its value in distributing lumber. Then the post Civil War era saw the coming of the railroad and highways. The golden age of river transportation

came to an end. The Upper Mississippi ceased being of any major economic importance.

The result of the successful campaign of various individuals and organizations was the construction of the nine-foot channel system on the Mississippi from St. Louis to St. Paul. The completion of the project just prior to the involvement of the United States in World War II in 1941 came at a very opportune time to supplement the overburdened transportation facilities of the nation.

Keywords: Commercial boat traffic, History

BELDING, D. L. 1928. Water temperature and fish life. Trans. Am. Fish. Soc., 58(1928):98-105.

Abstract: The influence of temperature upon fish life from the standpoint of environment, habits and activities. The material has been compiled from field observations on lakes and streams, from studies in fish environment and culture. Temperature not only governs distribution, but also is associated with resistance to disease and adverse ecological conditions such as oxygen supply and toxic substances.

Keywords: Temperature, Fish

BELLROSE, F. C. 1957. A spectacular waterfowl migration through central N. America. Ill. Nat. Hist. Surv. Biol. Notes. No. 36. 24 p.

Abstract: The compilation and analyses of the migration reports, which covered an area that extended from west central Canada to the Gulf of Mexico, provided information on the routes followed by waterfowl in the Mississippi Flyway, and the altitude, time, and speed of migration under storm conditions. Fortunately, population changes which resulted from the mass migration in several areas of the flyway could be measured, for some censuses were taken immediately before, some during, and some immediately after the migration. Waterfowl biologists throughout the Mississippi Flyway had been taking periodic censuses.

Keywords: Waterfowl, Migration

BELLROSE, F. C. 1968. Waterfowl migration corridors east of the Rocky Mountains in the United States. Ill. Nat. Hist. Surv. Biol. Notes. No. 61. 23 pp.

Abstract: The migration corridors outlined in this paper represent passageways, each connecting a series of waterfowl habitats extending from the breeding grounds to the wintering grounds. The directions taken by corridors between waterfowl habitats have been deduced from band recoveries, radar surveillance, and visual sightings from the ground and from aircraft. Population estimates on migration rest areas and winter areas of concentration provide a means of determining comparative densities of passage by species.

Keywords: Waterfowl, Navigation, Migration

BELLROSE, F. C. 1974. The effect of short-term weather conditions on the migration of waterfowl. Illinois State Natural Survey Urban Federal Aviation Administration. Washington, D.C. System Research and Development Service. Bureau of Sport Fisheries and Wildlife, Laurel, MD. Patuxent Wildlife Research Center.

Abstract: The effect of weather conditions on the fall migration of seven duck species was studied in the Illinois and Mississippi River Valleys of Illinois, October 1 - December 5, 1948-1968, and on observed flock arrival and departure dates. Arrivals were treated as if the ducks departed Fargo, ND, the evening before they arrived, and departures were related to weather conditions at Peoria, IL. A stepwise multiple regression equation was used to evaluate the effect of weather elements on duck departures. Correlations were highest for mallards (Anas platyrhynchos) and canvasbacks (Aythya valisineria). Since correlation of weather conditions with duck departures generally was low, endogenous (physiological) factors apparently affected departure time more than exogenous (environmental) ones. Temperature and pressure were the weather elements most frequently associated with duck departures.

Keywords: Migration, Ducks, Waterfowl, Canvasback, Birds, Distribution, Climatology, Temperature, Illinois River, Illinois, Mallard

BELLROSE, F. C. and R. D. CROMPTON. 1970. Migrational behavior Mallards and Black Ducks as determined from banding. Ill. Nat. Hist. Surv. Bull. 30(3):167-234.

Abstract: The objectives of the analysis presented in this paper were to determine; a) the migration patterns as shown by band recoveries from mallards and black ducks, b) the variation in migration patterns of mallards banded at various localities in the Mississippi Flyway, c) the degree of variation in migration patterns of mallards from year to year, d) the period of time mallards remain at a given area on the flyway, and e) the chronology of migration in the mallard as shown by recoveries.

Keywords: Migration, Ducks, Banding, Mallard

BELLROSE, F. C. and J. G. SIEH. 1960. Massed waterfowl flights in the Mississippi flyway, 1956 and 1957. Wilson Bull., 72:29-59.

Abstract: The present paper largely concerns the grand passage of waterfowl in 1956 and 1957. Although the 1956 and 1957 flights were not so large as the one in 1955, they were still of unusual scope and magnitude in the Mississippi Flyway. They are discussed here not so much because of their size, but primarily because of the unique complementary observations made in Iowa and in Illinois.

Keywords: Waterfowl, Migration

BELT, C. B., JR. 1975. The 1973 flood and man's constriction of the Mississippi River. Science 189(4204):681-684.

Abstract: The progressive constriction of the Mississippi River for navigation since 1837 has caused bottom erosion in some stretches. In others the bottom oscillates up and down with time. The high stages rise much more rapidly. Constriction of the river channel causes flooding and makes floods higher, thus navigation works degrade the protection afforded by levees. The combination of navigation works and levees causes significant rises in the stages of floods. Additional channel constiction and levee building will cause further problems. The 1973 flood's record was manmade.

Keywords: Flood, Levees

BELTHIUS, L. C. 1947. The geography of lumbering in the Mississippi River Section of eastern Iowa. Ph.D. Thesis, Univ. Michigan. 250 pp.

Abstract: This study of lumbering and woodworking in Iowa, a treatise in historical economic geography, shows many changes over a period of time. These explain the distribution patterns formed by the industry in the three periods which cover its active life: pioneer period, rafting of logs and lumber, and the third which is marked by local and national sources of materials and local and national markets.

Keywords: Survey, Vegetation, Habitat alteration, Recolonization, Iowa

BEMAN, L. T. 1928. Flood control (compiler). The H. W. Wilson Co., NY. 162 p.

Abstract: Flood control, it is now generally agreed, is a matter of engineering. The chief difference of opinion on the subject of flood control is as to who shall pay the cost. Discussion follows on whether the federal government should assume the entire responsibility for flood control and pay the entire cost.

Keywords: Flood

BERG, G. 1971. How's your virus I.Q. Water Wastes Eng. 8(10): 35-38.

Abstract: Rare amounts of different types of viruses are present in natural waters due to sewage. Water can be removed by membrane filtration, polyelectrolyte technique and osmotic ultrafiltration and electroosmosis. Water can be treated with ozone, chlorine, iodine, bromine, ultraviolet radiation or gamma irradiation.

Keywords: Water quality, Disease, Bacteria

BERGT, SR. M., CDP. 1973. Qualitative and quantitative study of the distribution of macroscopic plants in Lake LaSalle. M.S. Thesis, St. Mary's College, Winona, MN. 38 p.

Abstract: In order to aid in the solution of the problem of how to clear the vegetation from Lake LaSalle, a study of the kinds of plants present, their biomass and their distribution was undertaken. Diving with the aid of

a Johnson Air Buoy, bottom samples were collected at one foot increments from a depth of one foot to nine feet.

Keywords: Aquatic plants, Survey, Distribution, Biomass

BERGUSON, S. R. 1973. The effects of heat and entrainment on the flathead minnow (Pimephales promelas Rafinesque). M.S. Thesis, St. Cloud State Univ., St. Cloud, MN. 78 p.

Abstract: Field and lab projects were developed to study the effect of heat of a power plant. Lab was simulated thermal and temporal conditions of entrainment. Mean oxygen consumption rate of fish did not change with instaneous temperature change. Temperature test fish were acclimated to 19 C, death occurred with an additional 15 C rise. Fish acclimated to 16.8 C exhibited a loss of equilibrium with an additional 15 C rise.

Field study consisted of introducing fish into cooling water and recaptured in discharge canal. Immediate mortality was 88.2-98.4%. Direct relationship evident between percent immediate mortality and maximum temperature reached during entrainment. Also relationship present between percent immediate mortality and extent the maximum temperature reached exceeds the upper incipient lethal temperature of test fish.

Keywords: Fish, Thermal effluent, Mortality, Research, Entrainment, Flathead minnow

BERNER, L. M. 1947. A limnological survey of the Missouri River from its mouth to the Iowa State line during the summer of 1945. M.A. Thesis, Univ. of Missouri. 167 p.

Abstract: Eleven stations between the Iowa state line and the mouth of the Missouri River were studied. Plankton and macrobenthos distribution is discussed. Carp, buffalo, and catfish are the important commercial catch species.

Keywords: Limnology, Missouri River, Survey

BERNER, L. M. 1951. Limnology of the Lower Missouri River. Ecology. 32(1):1-12.

Abstract: The high turbidity, usually greater than 3000 ppm, determined the main characteristics of the lower Missouri

River. The maximum temperature was 82 F. The minimum D.O. was 3.5 ppm. Probably due to turbidity, the phytoplankton was less common than the zooplankton. However, high pulses during July and October switched the predominance of phytoplankton due to pulses of Pediastrum and Fragilaria, respectively. Factors thought to be responsible for the high turbidity: a mean current velocity of 2-7 mph and a shifting substratum. Chironomidae, the dominant benthos, averaged less than half pound per acre. The fish community composed a commercial yield of approximately 10 pounds per acre per year and consisted of carp, buffaloes and catfish.

Keywords: Missouri River, Limnology, Ecology, Phytoplankton Zooplankton, Fish, Benthos, Plankton

BERNHARD, H. F. and J. H. HUGHES. 1975. Environmental monitoring at Quad-Cities nuclear generating station. Am. Nuc. Soc. Trans., Vol. 22, No. TANSAO 22 1-836, 2 pp.

Abstract: The monitoring was designed to determine baseline ecological conditions in the river and was used to predict potential thermal effects on river biota prior to station startup. When the station became operational for 1 unit in 1972, operational monitoring was designed and continued to study the possible environmental impacts of the condenser discharge cooling water flow to river ecology. Special studies were also conducted to evaluate phytoplankton and zooplankton entrainment, impingement studies, and studies to reduce fish impingement.

In view of the findings obtained from monitoring during open-cycle operation, Commonwealth Edison can only conclude that this mode of condenser water flow has had no adverse impact on biotic communities in the Mississippi River near the station. In addition, Commonwealth has shown from its open-cycle monitoring results that the closed-cycle spray canal, installed as an operating licensing condition, is not necessary since there is no environmental benefit to be gained by having been forced to go closed cycle.

Keywords: Thermal effluent, Nuclear power, Habitat alteration, Limnology, Ecology, Fish, Phytoplankton, Zooplankton, Plankton, Mortality, Effluent, Temperature

BERTRAND, B. A. 1971. Fish Population Survey of Tailwater, Lake and Slough Habitats in Pool 18, Miss. River. Ill. Dept. Cons., Div. of Fisheries.

Abstract: A survey of different habitat types in Pool 18 of the Mississippi River conducted May through October 1971. Lake, slough and tailwater habitats were sampled with electroshocking. 4052 fish of 39 species were collected: 1390 fish of 27 species from the tailwater, 1037 fish of 25 species from slough, and 1625 fish of 22 species from lake habitats.

Keywords: Habitat, River lake, Slough, Tailwater, Pool 18, Electroshocking

BERTRAND, B. A. 1974. Fishing the Mississippi. Ill. Dept. Cons., Div. of Fisheries.

Abstract: The vast sport fishery resources of the Mississippi River provide Illinois fishermen with sport as fine as that found anywhere in the state. Major game fish of the river include crappie, largemouth bass, walleye and sauger, channel catfish, white bass, and bluegill. However, the river does not receive the amount of fishing pressure it could stand, even though many Illinoisans are crying for a place to fish. It is with the hope of bringing fish and fisherman together, that this fishing guide to the pooled Illinois portion of the Mississippi River is provided. Fishery biologists have sampled many locations on the river over the past three years. Their data and aerial fisherman counts, creel censuses, access surveys, and discussion with other people knowledgeable of the river provide the basis for this guide.

Keywords: Fishing, Navigation, Sport fishing, Fish

BERTRAND, B. A. 1975. 1973-1974 Aerial Fisherman Counts on the Mississippi River Pools 12-18. Ill. Dept. Cons., Div. of Fisheries.

Abstract: Aerial surveys of recreational use on the Mississippi River bordering Illinois were conducted from January-June in 1973 and 1974 to pinpoint better fishing areas and to provide information as to the amount of use these areas received.

Keywords: Creel census, Pools 12-18

BERTRAND, B. A. and J. ALLEN. 1973. Fish Population Survey of Aquatic Habitat Types in the Mississippi River near Cape Girardeau, Missouri. Ill. Dept. Cons., Div. of Fisheries.

Abstract: Five locations near Cape Girardeau were sampled monthly from April through November with electroshocking. Also minnow seining was done in June, July and September.

Keywords: Fish, Abundance, Distribution, Missouri, Electroshocking

BERTRAND, B. A., and L. L. DUNHAM. 1972. Efficiency of four Fish Sampling Devices at Seven Stations on the Mississippi River in August and September 1972. Ill. Dept Cons., Div. of Fisheries.

Abstract: A 230 V. shocker, trap net, gill net and trammel net were used to sample seven stations in the Mississippi River in August and September 1972. Results indicate that netting gear can provide samples as good or better than shocker samples in certain areas.

Keywords: Fishing, Equipment, Sampling

BERTRAND, B. A. and B. DUNN. 1974. Fish Population Survey of Stations in Pools 21, 24, 25 and 26 of the Mississippi River. Ill. Dept. Cons., Div. of Fisheries.

Abstract: Sampling conducted in the above pools with electroshocking, trap nets, and gill nets in August and October 1973. By electroshocking, 21 species were found in pool 21, 16 in pool 24, 27 from pool 25, and 17 from pool 26. Bluegill, carp and crappie and largemouth bass were most common besides shad.

Keywords: Fish, Pools 21, 24, 25 and 26, Survey

BERTRAND, B. A. and D. GARVER. 1973. Fish Population Survey of Aquatic Habitat Types in the Mississippi River near Chester, Illinois. Ill. Dept. Cons., Div. of Fisheries.

Abstract: Six stations were sampled near Chester area once a month from April through November by electroshocking.

Keywords: Fish, Illinois, Survey, Electroshocking

BERTRAND, B. A. and R. LOCKHART. 1973. Fish Population Survey of Aquatic Habitat Types in Pool 26 and below 26 in the Alton area of the Mississippi River. Ill. Dept. Cons., Div. of Fisheries.

Abstract: Three stations in pool 26 and three below pool 26 were sampled monthly from May through October by electroshocking. Seining was also done in May, July and September.

Keywords: Fish, Pool 26, Survey, Electroshocking

BERTRAND, B. A. and T. MILLER. 1973a. Fish Population Survey of Aquatic Habitat Type in Pool 25 of the Mississippi River. Ill. Dept. Cons., Div. of Fisheries.

Abstract: Sampling was conducted by electroshocking at five habitat types in Pool 25.

Keywords: Fish, Pool 25, Survey

BERTRAND, B. A. and T. MILLER. 1973b. Fish Population Survey of Aquatic Habitat Types in Pools 12 and 13 of the Mississippi River. Ill. Dept. Cons., Div. of Fisheries.

Abstract: Five locations in pool 12 and one in pool 13 were sampled by electroshocking.

Keywords: Fish, Pools 12 and 13, Survey

BERTRAND, B. A. and T. MILLER. 1974. Fish Population Survey of Stations in Pools 13, 14, 15 and 16 of the Mississippi River. Ill. Dept. Cons., Div. of Fisheries.

Abstract: Sampling was conducted in the above pools by electroshocking, gill nets and trap nets in April, May, July and October 1973. Twenty-nine species from Pool 13, 18 from Pool 14, 6 from Pool 15 and 29 from Pool 16 by electroshocking. Other 2 methods provided little additional information. Bluegill, carp, crappie species and largemouth bass were most common species excluding shad.

Keywords: Fish, Pools 13-16, Survey

BERTRAND, B. A. and A. PULLEY. 1974. Fish Population Survey of Stations in Pools 12 and 13 of the Mississippi River. Ill. Dept. Cons., Div. of Fisheries.

Abstract: Sampling conditions with electroshocking, gill nets, and trap nets. Electroshocking provided 30 species from Pool 12, with bluegill, carp, white and black crappie and largemouth bass the most common (excluding shad). In Pool 13, 27 species were found, with bluegill, carp, crappies and largemouth bass most common.

Keywords: Fish, Pools 12 and 13, Survey

BERTRAND, B. A. and K. RUSSELL. 1973. Fish Population Survey of Aquatic Habitat Types in Pool 19 of the Mississippi River. Ill. Dept. Cons., Div. of Fisheries.

Abstract: Five stations in Pool 19 were sampled monthly from April through October by electroshocking. Minnow seine samples were also taken in May, July and September.

Keywords: Fish, Pool 19, Survey

BERTRAND, B. A. and K. RUSSELL. 1974. Fish Population Survey of Stations in Pool 17 and 18 of the Mississippi River. Ill. Dept. Cons., Div. of Fisheries.

Abstract: Sampling was conducted in pools 17 and 18 using electroshocking, trap nets and gill nets in May, July and October and a bag seine in July 1973. Electrofishing collected 22 species in pool 17 and 30 species in pool 18. Other means provided 6 additional species in pool 17 and 4 additional in pool 18. Bluegill, carp, crappies and largemouth bass were most common besides shad.

Keywords: Fish, Pools 17 and 18, Survey

BIANCHI, A. A. 1965. A history of Winona. Soil and Water Cons. Dist. Research paper presented to Graduate Council, Winona State College, Winona, MN. 66 p.

Abstract: This study concludes that soil conservation districts are necessary to conserve water and soil and federal financial support is needed. Another conclusion reached is that the concept of local control of the districts has been maintained over the federal government Presently Winona is served by two soil conservation

districts which must be merged. Farmers must also be kept constantly aware of soil and water conservation.

Keywords: History

BLAIR, D. 1968. Model flood plain regulations for Iowa - a progress report. IN M. D. Dougal (ed.) Flood plain management. Iowa's experience. Iowa State University Press, Ames, IA. p. 167-182.

Abstract: This article reviews and reports briefly on the legal and administrative problems and prospects of flood plain regulation. This will provide the flood plain planner and/or manager with a good idea of the law concerning flood plain regulation.

Keywords: Flooding, Iowa

BLAIR, W. A. 1930. A raft pilot's log, a history of the great rafting industry on the Upper Mississippi 1840-1915. Arthur H. Clark Co., Cleveland.

Abstract: This book gives a personal account of a rafting trip down the Mississippi River with tales of steamboats, industry and riverboats along the way.

Keywords: History

BLUM, J. L. 1956. The ecology of river algae. Bot. Rev. 22 (5):291-331.

Abstract: Discusses river algae communities (Phytoplankton and Periphyton) in relation to current, depth, temperature, light, turbidity and chemical parameters (including dissolved gases, pH, phosphorus and nitrogen). Productivity, reproduction, colonization and succession, periodicity and distribution are also discussed. Many references concerning specific algal taxa.

Keywords: Ecology, Phytoplankton, Chemistry, Periphyton

BOHLEN, H. D. 1975. Ash-throated flycatcher in Illinois. Summary of records east of the Mississippi River. Auk 92(1): 65-166.

Abstract: This article briefly discusses the sighting of an Ash-throated Flycatcher in Illinois. The size of the wings, skull and tail were given along with weather conditions at the time of the sighting.

Keywords: Birds, Distribtuion, Movement, Flycatcher

BOLAND, T. L. 1974. Sturgeon...a prehistoric remnant. Iowa Conserv. 33(10):8-9, 11.

Abstract: Sturgeon are often referred to as a living fossil because of physical characteristics that place it early in the evolution of fishes. Sturgeon are best known for their black eggs made into caviar. Since little was known about the fish in our streams a tagging study of over 3,000 shovelnose along the Iowa shores of the Mississippi was conducted.

Keywords: Sturgeon

BOLLANT, R. J. 1974. Dredging Harmful, Winona Disproves It. Public Works Magazine. 104(3):72.

Abstract: Dredging has not been harmful to the Winona evnironment; it has been beneficial to it. The present economy of the city is healthy and only a small percent of the labor force is unemployed. The well-being of Winona has been dependent on dredging for many years.

Keywords: Dredging, Minnesota, Siltation, Development

BONNER, F. T. 1965. Some influences of soil moisture upon the survival and growth of planted hardwood seedlings in the Mississippi River Valley. D.F. Duke University. 123 p.

Abstract: Seedling survival and growth have been very erratic and generally poor in hardwood plantations in the South. Soil moisture, one of the major factors which influence planting success, is often too plentiful during late winter and early spring and deficient later in the growing season. The studies reported here were undertaken to assess the importance of early-season soil saturation and late-season moisture deficiency on the survival and first-year growth of planted hardwood seedlings.

Keywords: Wildlife, Habitat, Soil moisture

BORON, N. J. E. J. CECIL, and P. L. TIDEMAN. 1972. A survey of Attutudes Towards the Mississippi River as a total resource in Minnesota. Minnesota Univ., Minneapolis. Water Resources Research Center. 177 p.

Abstract: A survey of the attitudes of Minnesotans toward the use, maintenance and development of the Mississippi River in Minnesota was conducted. Background information on the diverse physical nature of the project Universe (those 23 Minnesota counties which the River flows through or is adjacent to) was collected covering the topics of waterflow, soils, population change, changing riparian land use, and recreational opportunities. Great physical and cultural diversity was found in the project Universe.

Keywords: Minnesota, Recreation, Flow, Development, Pollution, Water quality, Population

BRAASCH, M. E. and P. W. SMITH. 1965. Relationships of the topminnows Fundulus notatus and Fundulus olivaceus in the Upper Mississippi River Valley. Copeia, 1965 (1):46-53.

Abstract: In the upper Mississippi River vally, Fundulus notatus and F. olivaceus differ markedly in pattern and size, slightly in scale and ray counts and in proportions. These species tend to be microgeographically and ecologically separated, with notatus occurring in low-gradient streams and sloughs in relatively level areas, and olivaceus in fast, gravelly streams in upland areas. They have occurred together for 60 years or more in several stream systems in southern Illinois, and comparison of allopatric and sympatric samples suggests some character displacement. The more northern notatus is unable to penetrate the range of olivaceus in highlands but does so along the broad Mississippi River floodplain.

Keywords: Fish, Minnows

BRADSHAW, J. E. and D. O. TRAINER. 1966. Some infectious diseases of waterfowl in the Mississippi flyway. J. Wildl. Manage. 30(3):570-576.

Abstract: To establish the presence of selected infectious diseases in a "healthy" wild waterfowl population, a serologic and parasitologic study was initiated. Sera from 123 Canada geese and 179 mallards were screened

for antibodies against arboviruses. There was no neutralizing antibody detected against western viral encephalitis, viral encephalitis, St. Louis viral encephalitis, Venezuelan viral encephalitis, California viral encephalitis, or vesicular stomatitis. Sera from 55 ducks and 12 geese were negative for agglutinating antibodies to Salmonella pullorum, Salmonella typhimurium, and Mycoplasma gallisepticum. Fifty-five and 11 goose sera were negative for complement-fixing antibodies or ornithosis. The most significant serologic finding was the presence of Newcastel disease antibody. Forty (17 percent) of 236 Canada geese were positive for Newcastle disease antibody. Thirtseven (14 percent) of 267 mallard ducks had antibody titers for Newcastle disease virus. A limited study of parasitism revealed a low prevalence of Haemoproteus, Leucocytozoon, and microfilariae in both geese and mallards as well as Plasmodium in wild geese. The significance of the serological and parasitological findings is discussed.

Keywords: Waterfowl, Disease, Parasites

BRADY, J. T. 1976. Environmental implications of dredged material disposal on the upper Mississippi River. Presented at World Dredging Conf. on Env. Effects and Technology of Dredging, San Francisco, Jul 10-12, 1976, 321 p. (16).

Abstract: Technical report: The upper Mississippi River is an important link in the transportation system of the midwest. To maintain navigation, it is necessary to dredge the main channel of the river. More than 4 million cu yd/yr of material are dredged. The dredged material is composed mostly of either sand or sand-silt substrate. The adverse environmental impacts, on both land and water, or disposal of the dredged material are discussed. Probably the most damaging aspect of dredged material disposal is the filling in and consequent destruction of the productive wetland areas, such as marshes, sloughs, and side channels. Possible solutions to the disposal problem are suggested.

Keywords: Dredging, Upper Mississippi River, Channelization, Sedimentation, Siltation, Habitat alteration, Slough, Side channel

BRANDT, T. M. and L. T. FOODY. 1972. Quantitative protozoan study during 1971-1972 ice conditions of the Upper Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 26 p.

Abstract: The zooplankton population of a section of Pool 3 of the Upper Mississippi River near Red Wing, Minnesota was studied by two undergraduates of St. Mary's College. The winter study covered a period from February 5, 1972 thru March 18, 1972.

Samples were collected and concentrated to 300 ml through a silk-cloth plankton net and subsequently to membrane filters. The filter was analyzed for protozoans by using interference phase-contrast microscope.

An Index of Diversity was calculated by using a computerized version of Cairns' Sequential Comparison Index. Although the technique proved to be adequate for the task, the results were inconclusive.

Keywords: Protozoa, Zooplankton, Ice, Minnesota

BRANSON, B. A. 1974. American Paddlefish-Sign of Distress. Nat'l. Parks Conserv. Mag. 48(1):21.

Abstract: This primitive fish of the Mississippi watershed is threatened by exploitation and dam building. Drastic measures must be taken to ensure the survival of this valuable native fish. Snagging must be prohibited at all times and spawning grounds must be protected during the time of spawning.

Keywords: Fish, Fishing, Endangered species, Ecology, Distribution

BREAULT, J. E. and SR. D. ULRICH. 1972. Midsummer studies of a year round artificial substrate for macroinvertebrates population in the Upper Mississippi River. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: This was a preliminary study, undertaken during the months of June and July, 1971, to assess the feasibility of a particular artificial substrate in determining macroinvertebrate species diversity on seven transects above Lock and Dam #3 of the Mississippi River at Red Wing, Minnesota. Previous studies showed that biplate samplers were ineffective for year-round use, resulting in the current design of a new wood and concrete sampler. Both quantitative and qualitative

studies were undertaken and organisms were reduced taxonomically to the species level whenever possible. Comparative analysis of these experimental data indicated that the new wood and concrete sampler is an effective means of determining macroinvertebrate populations, and should be an effective year-round sampling device.

Keywords: Benthos, Survey, Sampling, Equipment

BRIMER, 1977. Fish impingement at Dairyland Power Cooperative's Genoa Site. M.S. Thesis, Univ. of Wis., LaCrosse, WI.

Abstract: The intent of this investigation was to measure fish impingement and entrainment at Dairyland Power Cooperative's Genoa, Wisconsin facilities on the Mississippi River. Techniques were designed and samples were taken to determine the rate of fish impingement and the mortality of those fish impinged. Fish impingement is the sharp collision of fish with a physical member of the intake structure, in this case.

Keywords: Impingement, Fish, Wisconsin

BROOK, A. J. 1970. Attached algae studies of the Mississippi River at Monticello, Minnesota. In NSP environmental monitoring program annual report for 1969. Northern States Power Co., Minneapolis, MN. 11 p.

Abstract: Algal abundance in the samples was estimated by counts, pigment, and biomass analysis. Tables are presented which show major changes in mean algal abundance during this study period.

Keywords: Phytoplankton, Minnesota, Nuclear Power

BROWN, H. W. 1974. Handbook of the effects of temperature on some North American fishes. Amer. Electric Power Service Corp. Canton, Ohio.

Abstract: A discussion of the thermal effects of effluent water on selected species of North American fish.

Keywords: Temperature, Fish, Power

BRUNET, P. J. 1977. The Corps of Engineers and navigation improvement on the channel of Upper Mississippi River to 1939. M.A. Thesis. Univ. Tex., Austin. 195 pp.

Abstract: Over the past 150 years, commercial interests and the United States Army Corps of Engineers have advocated a number of projects to improve navigation on the upper Mississippi River. As a result, the upper Mississippi River has a permanent nine foot channel maintained by twenty-seven locks and dams. The purpose of this thesis is to show why, how, and to what effect the Engineers improved the channel for navigation up to, and including, the development of the permanent nine foot channel. It traces the Engineers from their first examination of the rivers in 1829 to the completion of the construction of the twenty-seven locks and dams with particular emphasis on the ecological effect of navigation improvement.

Keywords: Navigation, Channelization, Nine-foot channel

BUILDER, J. M. 1976. The emergent aquatic vegetation of Weaver Bottoms. unpubl. B.S. Thesis, Env. Stud., St. Mary's College, Winona, MN. 33 pp.

Abstract: To provide baseline data for comparison with other years' vegetation or other parameters, a large, detailed map of the emergent plants was developed. This map was made using extensive field work, and black and white, color, and color infrared aerial photography.

A slide of the completed map was used to make smaller species maps. It was found that the most common plants were the arrowheads (Sagittaria latifolia and S. rigida), lotus (Nelumbo lutea) and white water lily (Nymphaea tuberosa).

Comparison of 1975 vegetation with past years' vegetation was done using old black and white aerial photos. Maps were made from the available photos by tracing the outline of the terrestrial areas and the aquatic vegetation. From these it could be seen that there had been a gradual decrease in vegetation until 1965. Between 1965 and 1971 a large portion of the vegetation disappeared. The cause of this disappearance is not yet known, although there are some theories put forward.

Keywords: Emergent vegetation, Aquatic plants, Weaver Bottoms

BUNNELL, L. H. 1897. Winona and its environs on the Mississippi in ancient and modern days. Jones and Kroeger. Winona, MN.

Abstract: This book relates the history of Winona from the first settlement days to the present with descriptions of industry and riverboats.

Keywords: History

BUR, M. T. 1976. Age, growth and food habits of the catostomidae in Pool No. 8 of the Upper Mississippi River. M.S. Thesis, Univ. Wis. LaCrosse, WI.

Abstract: Age, growth and food habits of 10 catostomids from Pool No. 8 of the Upper Mississippi River. 38 ecotypes were investigated from June through August 1975. Main channel and backwater habits were both examined. Four species comprised 94.2% of the catostomids. The most abundant was the shorthead redhorse (Moxostoma macrolepidoteum). Greatest growth increment was 106.4 mm. Food item was Tendipedidae larvae, 15.8% (by number) and 41.2% (by volume).

Keywords: Pool 8, Age and growth, Food habits, Catostomidae

BURKS B. D. 1953a. The mayflies or Ephemeroptera of Illinois. Ill. Nat. Hist. Surv. Bull. 25(1).

Abstract: This book describes the advances which have occurred in the knowledge of mayflies since they were first written about. Discussion is given to habitat, life history, food habits, and taxonomic keys.

Keywords: Invertebrates, Illinois, Mayflies, Life history, Food habits

BURKS, B. D. 1953b. The mayflies, or Ephemeroptera, of Illinois. Ill. Nat. Hist. Surv. Bull. 26(1): 1-216.

Abstract: Discussion of habitat preference, life history, food habits, emergence peaks, dispersal, rearing mayflies, collecting and preserving, external morphology, identification of sexes and classification (Keys).

Keywords: Invertebrates, Illinois, Mayflies, Life history, Food habits, Keys, Taxonomy

BURR, B. M. 1974. Taxonomic status of stonerollers (Campostoma aggasiz) in the Upper Mississippi River Valley (Pisces: Cyrinidae). M.S. Thesis, Univ. Ill.

Abstract: The objectives of this study were to determine which taxonomically recognizable populations are present in the area; to elucidate the geographic variation within these entities; to collate the published information; and to provide a clearer understanding of the relationships, evolution, and zoogeography of these fishes.

Keywords: Taxonomy, Fish, Upper Mississippi River, Stoneroller

BURR, B. M. and P. W. SMITH. 1976. Status of the large-scale stoneroller Campostoma oligolepis. Copeia. (3): 521-531.

Abstract: Based on an examination of 1,450 stonerollers from throughout the upper Mississippi River valley (embracing the total range of the taxon oligolepis), the specific distinctiveness of Campostoma anomalum and C. oligolepis is confirmed. C. anomalum is generally distributed throughout the entire area from central Wisconsin southward, except for localized areas where suitable habitat is lacking. C. oligolepis has a disjunct range, occurring from northern Wisconsin and adjacent Minnesota and Iowa southward into central Illinois and also in the Ozarks of Missouri and Arkansas. The northern population of oligolepis is rather homogeneous and differs from anomalum more sharply than does the Ozark population, which shows considerable variation from drainage to drainage. In agricultural areas of Illinois and adjacent Wisconsin, Iowa, and Minnesota, C. oligolepis is being supplanted by the ecologically more tolerant C. anomalum.

Keywords: Non-Game, Fish, Fishing, Taxonomy, Distribtuion, Ecology, Stoneroller

BUTLER, R.L. 1948. Preliminary report of the sheepshead fishery of the Upper Mississippi River. UMRCC Invest. Rept. No. 25. p. 78-84.

Abstract: During the summer of 1948, from June first to October first, three units of the Upper Mississippi River Survey were studying different aspects of the River fishery. These studies were: (1) mobile test netting, (2) stationary test netting, and (3) experimental trotline

fishing. Another study was also proposed, that of obtaining data from the commercial fishery summer catch. Unfortunately, because of insufficient personnel, this part of the summer program was not started.

Keywords: Fish, Survey, Life history, Pools 3, 4, 5A, 6, 8, 9, 10 and 11, Lake Pepin, Wisconsin, Minnesota, Iowa, Sheepshead

BUTLER, R. L. 1951. The age and rate of growth of the sheepshead, Aplodinotus grunniens Rafinesque, in the Upper Mississippi River navigation pools. M.S. Thesis, Univ. of Minn., 54 pp.

Abstract: Grand average length and weight from calculations of measurements of 902 sheepshead during 1946, 1947 and 1948. Body-scale relationship is based on 608 measurements and found to be isometric. Differences in calculations between males and females is inconsequential. Generally, high water stimulates increased growth and so does impoundment. Males mature sooner than females. May through June is general spawning time.

Keywords: Age and growth, Fish, Pools 3, 4A, 5A, 6, 9, 10 and 11, Life history, Sheepshead

BUTLER, R. L. 1962. The status of the freshwater drum, Aplodinotus grunniens, Rafinesque, in the commercial fishery of the Upper Mississippi River. Ph.D. Thesis. Univ. of Minn. 183 p.

Abstract: This study summarizes the physical and chemical factors of the river and a review of the climatic influences bearing upon freshwater drum production. From 1930-1950, annual drum production in the Upper Mississippi River varied from 1/2 to over 2 million pounds. The highest drum catch occurred in 1944 (2,187, 845 lbs). Approximately 10% of the Upper Mississippi catch is represented by freshwater drum and it ranks fourth in value.

Keywords: Fish, Commercial fishing, Survey, Production, Upper Mississippi River, Freshwater drum, Catch

BUTLER, R. L. 1965. Freshwater drum, Aplodinotus grunniens, in the navigational impoundments of the Upper Mississippi River. Trans. Am. Fish. Soc. 94(4): 339-349.

Abstract: Scale samples taken from fish during 1944 to 1948 in order to assay the drum fishery of the Upper Mississippi River. Total and fishing mortality rates calculated for heavily and lightly fished populations in the impoundment system of 26 dams.

Keywords: Upper Mississippi River, Dam, Impoundment, Fish, Mortality, Temperature, Spawning, Freshwater drum

BUTLER, R. L. and L. L. SMITH, JR. 1949. The age and rate of growth of the sheepshead, Aplodinatus grunniens (Rafinesque), in the Upper Mississippi River navigational pools. Trans. Am. Fish Soc. 79: 43-54.

Abstract: This study is one of a series of studies made of the fisheries of the upper Mississippi River as part of the program of the Upper Mississippi River Conservation Committee. The scale method was validated for the species and growth rates were calculated. Latitude was not a factor in the growth of 902 sheepshead taken from navigation pools 4A, 8, 10, and 17. Growth rates within different areas of the same pool and from pool to pool were sufficiently alike so that the growth from Lake Pepin to Muscatine, Iowa, can be considered uniform.

Sheepshead from the upper Mississippi River grow more rapidly than those of Lake Erie. Average growth for the first year was 4.9 inches followed by a 4.0 inch growth during the second year. At the end of the seventh year they had reached a total length of 18.1 inches, 2.3 inches longer than 7-year-old sheepshead from Lake Erie. Annual growth rates observed for the period 1939 through 1947 were 7.8 percent above the average in 1939 and 7.3 percent rates and average annual water levels. During the third year of growth 23 percent of the males reach maturity. The first mature females were observed during their fifth year. Growth rates of earliest maturing males and females were far above average.

Management implications of these investigations of the sheepshead are (1) the uniformity of the growth pattern requires uniform regulations in the area studied and (2) maintenance of spawning stock is dependent on adequate survival of 16-inch females, the length at which more than 50 percent of the females are mature.

Keywords: Age and growth, Fish, Upper Mississippi River, Sheepshead

CAILLOUET, C. W. JR. 1968. Lactic acidosis in channel catfish. J. Fish. Res. Board Can. 25(1):15-23.

Abstract: Channel catfish were subjected to 5 or 10 min of anoxia (removed from water) to rapidly increase blood lactic acid concentration. Respiratory rate increased in fish with lowered blood pH and with increased blood lactic acid concentration during the 10 min after fish were returned to water after anoxia. Fish not treated had a mean blood pH of 7.8. Blood pH decreased in catfish subjected to anoxia 5, 10, and 15 min and decreased further when pH was associated with loss of equilibrium and death in catfish subjected to transportation and handling.

Keywords: Fish, Research, Channel catfish, Catfish

CALL, R. E. 1885. A geographic catalogue of the Unionidae of the Mississippi Valley. Bull. Des Moines Acad. Sci. 1: 5-57.

Abstract: The intention of this tentative catalogue is to place within the reach of students, a convenient geographic resume of the Unionidae of the Mississippi Valley, and at the same time to prepare the way for an intelligent discussion of the biologic and geologic problems which their numbers and distribution suggest. Three genera, Anodonata, Margaritana, and Unio are classified in six categories: Number of species common to both sides of the Mississippi, occuring only east of the Mississippi, occuring only west of the Mississippi, limital, foreign, and indefinite.

Keywords: Benthos, Clams, Distribution

CANFIELD, H. L. 1918. Methods of collecting and hatching buffalo fish eggs at the U.S. Fisheries Biological Station, Fairport, Iowa. Trans. Am. Fish. Soc. 47(3): 85-88 Soc. Columbus, Ohio.

Abstract: Rapidly decreasing supply of the food fishes of the Mississippi River and its tributaries necessitates acquiring knowledge of their habits. Not until the set-up of Fairport lab did anyone have any success breeding these fish. These methods of culture are discussed.

Keywords: Fish management, Iowa, Catch, Buffalofish, Fish

CANFIELD, H. L. 1947. Artificial propagation of those channel cats. Prog. Fish. Cult. 9(1):27-30.

Abstract: The life history of the channel catfish (Ictalurus punctatus) was studied and the method of artificial propagation of this species was devised by the U.S. Bureau of Fisheries, Fisheries Biological Station, Fairport, Iowa. This species has been successfully reared at a number of fish hatcheries that have followed the Bureau's practices.

Keywords: Fish management, Propagation, Channel catfish, Catfish, Fish

CARBINE, W. F. 1942. Sphaeriid clams attached to the mouth of young pike. Copeia 3:187.

Abstract: A note on the observation of sphaeriid clams attached to the mouths of northern pike.

Keywords: Clams, Pike

CARLANDER, H. B. 1951. A history of fish and fishing in the Upper Mississippi River. M.S. Thesis, Iowa State College, Ames, Iowa. 146 pp.

Abstract: The present study is a historical background of the river in relation to the fish and fishing, both sport and commercial.

Keywords: Fish, History, Sport fishing, Commercial fishing

CARLANDER, H. B. 1954. A history of fish and fishing in the Upper Mississippi UMRCC. Iowa Cons. Comm. Des Moines, IA. 96 pp.

Abstract: Since the 1930's the flow of the Mississippi River has been altered through a series of locks and dams. Pools have been created behind these structures and the lotic ecology has been greatly altered.

Keywords: Upper Mississippi River, Fish, Wildlife, Pollution, History, Minnesota, Missouri, Wisconsin, Iowa, Illinois

CARLANDER, K. D. 1950. A handbook of freshwater fishery biology. Wm. C. Brown Co., Dubuque, IA. 281 pp.

Abstract: A handbook is an index to the literature on certain aspects of the life histories of fresh water fish. It also summarizes data on the life histories of the fish with range and habitat, length-weight relationships, growth data, food habits, and sizes of fish.

Keywords: Fish, Life history

CARLANDER, K. D. 1953. First supplement to a handbook of freshwater fishery biology. Wm. C. Brown Co., Dubuque, IA.

Abstract: This book is the next supplement to his first book entitled "A handbook of freshwater fishery biology." It updates information on fish life histories, range, habitat, growth and size.

Keywords: Fish

CARLANDER, K. D. 1956. Iowa cooperative fishery unit symposium on sampling problems in creel census, held at Iowa State College, Ames. 80 pp.

Abstract: A symposium which dealt with the following topics: Minnesota creel census, creel census of several Iowa lakes, evaluation of sampling techniques, and comments on designing creel censuses.

Keywords: Creel census, Sampling

CARLANDER, K. D. 1957. Iowa cooperative fishery unit symposium on evaluation of fish populations in warm-water streams held at Iowa State College, Mar. 25, 1957. 118 pp.

Abstract: The evaluation of fish populations are population estimates but should also include abundance, trends, and conditions of a population. Warm water streams provide one of the most difficult habitats for the study of fish populations. This paper discusses better methods to study warm water streams along with traps and other nets used to evaluate the populations.

Keywords: Fish, Temperature, Population

CARLANDER, K. D. 1969. Pre-dredging studies at Fort Madison Iowa. Paper given at the Mississippi River Research Consortium.

Abstract: The area below Ft. Madison contained sandy substrates and contained higher standing crops of fingernail clams. Nine sampling stations were near the proposed dredging site. Although fingernail clams were eaten by several species, they were not considered an important food source, except for migrating ducks.

Keywords: Clams, Sediment, Dredging

CARLANDER, K. D. and R. M. BAILEY. 1950. Keys for the identification of Iowa fishes. Iowa State College, Ames, Iowa.

Abstract: This key for Iowa fishes gives identification for families with an explanation of terms used in the key. These keys are largely dichotomous. An indication of the ditribution in Iowa is given after each species.

Keywords: Keys, Fish

CARLANDER, K. D., C. A. CARLSON, V. GOOCH and T. WENKE. 1967. Populations of Hexagenia mayfly naiads in Pool 19, Mississippi River, 1959-1963. Ecology 48(5): 873-878.

Abstract: June populations of Hexagenia naiads in Pool 19 of the Mississippi River were estimated at 3.6, 18.7, 6.7, 23.6 and 11.9 billion in 1959 to 1963, suggesting an alternate year cycle of abundance. Although population density varied in different sections of the river, little pattern was evident. Water depths from 0.5 to 6 m and bottom deposits from soft mud to soft muds with shells or plant debris had little consistent relation to population density. Sand and gravel areas had few or no Hexagenia. Naiads increased in average size in June. In late July after major emergences, there were few naiads collected, but small naiads increased in August. Flood may have shifted part of the population in 1960. Tendipes plumosus larvae were more abundant in 1961, when Hexagenis populations were lower, than in 1960. Usually H. limbata was the more abundant species (among naiads over 16 mm) in early June and in August and H. bilineata, in late June and July. Sex ratios were usually near 50:50.

Keywords: Invertebrates, Population, Pool 19, Mayflies

CARLSON, B. A. 1971. A bird census on two islands near Monticello, Minnesota, M.S. Thesis, St. Cloud State Univ., St. Cloud, MN. 49 p.

Abstract: A determination of the bird population on two islands near Monticello, Minnesota nuclear plant. A preoperational study occurring from November 29, 1968 through July 11, 1969. Winter, spring migrational and breeding bird census was taken. A census procedure was employed which is a combination of Williams spot-map method and strip census method. During winter census recorded 14 species with 21 established territories along Oxbow Island Trail. Twelve species and 21 territories were found on Cedar Island.

Keywords: Birds, Survey, Minnesota, Nuclear power

CARLSON, C. A., JR. 1960. Abundance of Mayfly naiads (Hexagenia spp.) in Pool 19, Upper Mississippi River; M.S. Thesis. Iowa State Univ. of Science and Technology, Ames, IA. 87 p.

Abstract: The present study was initiated in 1959 to supplement previous studies of important nuisance species of mayflies and caddisflies in the Keokuk, Iowa area. Knowledge of the behavior, distribution, and density of Hexagenia naiad populations were primary objectives.

Keywords: Upper Mississippi River, Pool 19, Invertebrates, Mayflies

CARLSON, C. A., JR. 1963. Bottom fauna of the Mississippi River near Keokuk, Iowa, with particular reference to possible control of Ephemeroptera and Trichoptera. Unpublished Ph.D. Thesis. Iowa State University of Science and Technology, Ames, Iowa. 199 pp.

Abstract: Study to examine the possible effects of chemical removal of immature mayflies and caddisflies from the Mississippi River, near Keokuk, Iowa. Mayfly populations of Pool 19 were estimated by collections of naiads in the pool and found to be much higher in 1960 than in 1959 or 1961. Flooding probably destroyed the habitats in early 1960 washing down naiads. Over 1400 benthos collections were made from eight sampling locations along the Illinois shore above Dam 19 in the summers 1960 and 1961.

Keywords: Benthos, Distribution, Ecology, Habitat management, Pool 19, Iowa, Mayflies, Caddisflies

CARLSON, C. A. 1966. Effects of three organophosphorus insecticides on immature Hexagenia and Hydropsyche of the

Upper Mississippi River. Trans. Am. Fish Soc. 95(1):1-5.

Abstract: Hexagenia naiads were readily handled in bioassay, but Hydropsyche larvae showed high mortality until handling was reduced by providing small screens on which they built cases. The screens could then be transferred readily. Hydropsyche larvae were much more sensitive to Co-ral and to Dylox than were bluegills, but the ratio of the 24-hour TLm values of Malathion to Hydropsyche to bluegills was only about 1 to 10. Malathion was less toxic to Hexagenia naiads than to bluegills, and Co-ral and Dylox gave only about a 1 to 10 margin for Hexagenia compared with bluegills.

Keywords: Upper Mississippi River, Insecticides, Invertebrates, Mayflies

CARLSON, C. A. 1968. Summer bottom fauna of the Mississippi River above Dam 19, Keokuk, Iowa. Ecology 49(1): 162-169.

Abstract: Over 1400 benthos collections were made from eight sampling areas near the Illinois shore of the Mississippi River above Dam 19 in the summers of 1960 and 1961. No significant difference was found in numbers of macroscopic organisms collected after sifting Ekman dredge contents through 20- and 40-mesh screens. Sphaerium transcresum was the most abundant organism and was the only organism collected at every sampling plot on each collection date. Hexagenia naiads were the most abundant insects at all sampling areas in 1960 Coeletanypus, Tendipes piunesus, Stenochironomus, oligochaetes, Campeloma, and Lioplus suboninus were also abundant and frequently collected. Several organisms were more abundant in 1961, when many population densities were low, than in 1960. As the most abundant insects emerged during each summer, other elements of the benthos increased in abundance. An average of 2,924 organisms/m^2 was collected in the study area. Major elements of the benthos seem to have changed little in the last 39 years. The study area had a climax community characteristic of mature streams and showed no evidence of serious pollution.

Keywords: Dam, Benthos, Pool 19, Iowa

CARLSON, D. 1978. Bibliography of Fishereis Studies on the Missouri river, Yankton, S.D. to its mouth. Mo. Dept.

Cons. Columbia, MO. 10 p.

Abstract: Short compilation of citations primarily concerned with fisheries of Missouri River. Also includes a few on phytoplankton and macroinvertebrates, but everything is restricted to the Missouri River (and a few tributaries) no lower downstream.

Keywords: Fish, Phytoplankton, Benthos, Missouri River, Bibliography

CARMAN, R. E. 1969. Fluorometric determination of current patterns within a slough in pool no. 6 of the Mississippi River. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: Current patterns within a backwaters region in the upper Mississippi River near Homer, Minnesota, were determined by detecting the dispersion of the flourescent dye Rhodamine WT through the Turner model 111 fluorometer during the summer of 1969. Most water within the slough was found to be lotic with variations in flow patterns being caused principally by changes in flow volume within the slough regulated by two Lock and Dams above and below the slough. Lentic waters were detected only in the more remote areas of the slough. Phytoplankton populations within the slough would be contributed by water flowing into it and those originating from the bottom of the slough. Most phytoplankton populations originating from the slough bottom would be carried out of the slough by the current.

Keywords: Hydrology, Slough, Pool 6, Methods

CARNEY, S. M. and A. D. GEIS. 1960. Mallard age and sex determinations from wings. J. Wildl. Mange., 24:372-381.

Abstract: This paper describes criteria used for determining the age and sex of mallards from detached wings.

Keywords: Duchs, Age and growth, Waterfowl, Mallard

CARON, L., J. MINOR and M. MEYER. 1976. Upper Mississippi River underwater feature detection capabilities of water penetrating aerial photography. Remote sensing applications in agriculture and forestry. IAFHE RSL Research Report 76-1, Minn. Univ. Inst. of Agriculture, Forestry and Home Economics, College of Forestry and the Agri-

cultural Experiment Station, Remote Sensing Lab. St. Paul, MN. 15 p.

Abstract: This study, funded by the U.S. Fish and Wildlife Service, was undertaken to ascertain the feasibility of Water-Penetration aerial photography for identifying submergent aquatic vegetation useful for wildlife management on the Upper Mississippi River Channel.

Keywords: Hydrology

CARTER, N. E. 1968. Age and growth of sauger in Pool 19 of the Mississippi River. Proc. Iowa. Acad. Sci. 75:179-183.

Abstract: Saugers were collected in the Mississippi River (Pool 1) in 1966 and 1967 as part of a study of fish ecology and food habits.

In August 1966, and June and July, 1967, condition did not increase with increase in length as expected from the slope of 3.184, but in the other seasons there was such an increase.

The average growth was similar to that reported for other sections of the Mississippi river. Growth was more rapid than that from Lake of the Woods, but slower than in new impoundments. Little difference in abundance of 1963 to 1966 year classes was evident.

Keywords: Pool 19, Dredging, Fish, Age and growth

CAWLEY, E. T. 1973. Final Report: Environmental impact assessment study, Pool 10, of the northern section of the Upper Mississippi River. N. Star Res. Inst., Minneapolis, Minn.

Abstract: The purpose of the environmental impact study is to assess the impacts, both positive and negative, of the Corps' activities on the Northern Section. These activities are defined as operations and maintenance activ- and mainly include operations of facilities (locks and dams) and maintenance of the navigation channel (dredging). Some activity also concerns recreation areas. Actually, the impacts on the environment of the earliest operations are also being sought, but most of the information will concern those of the presenct navigation system.

The studies are designated to identify the impacts and to assess their effects on both the natural and social environment. Such impact may include effects of river transportation on the area economy, effect of creation of the pools on recreational activities and wildlife habitat, effect of dredge spoil disposal on the natural ecosystem and on reactions, and many others. As a result of identification and assessment of the impacts, it may be possible to suggest ways of operating the facilities and maintaining the navigation and recreation system to amplify the positive and minimize the negative results of the Corp's activities.

Keywords: Pool 10

CHAMBERLAIN, T. K. 1931. Annual growth of fresh-water mussels. Bull. U.S. Bur. fish., Vol. XLVI, 1930 (1931). Bur. of Fish. Doc. No. 1103:713-739.

Abstract: Detailed study of the growth of fresh-water mussels representing four commercial North American species, using the "annual ring" method.

Keywords: Mussels, Benthos, Production, Methods, Age and growth

CHAMBERS J. E. and J. D. YARBROUGH. 1974. Parathion and methyl parathion toxicity to insecticide resistant and susceptible mosquitofish (Gambusia affinis). Bull. Environ. Contam. Toxicol. 11(4):315-320.

Abstract: The objectives of this study were to determine the levels of tolerance of mosquitofish to parathion and methyl parathion and to determine whether resistance to these two compounds appears to exist.

Keywords: Fish, Fishing, Pesticides, Toxicant, Mosquitofish

CHIN, E. H., J. SKELTON and H. P. GUY. 1973. The 1973 Mississippi River Basin flood: compilation and analysis of meteorologic, steam flow and sediment data. Geol. Surv. Prof. Pap. 937. Prep. by USGS and NOAA. Washington, D.C.

Abstract: Described in this report are the meteorological setting of the flood, an account of the general characteristics of associated precipitation, and an analysis of a sample of significant precipitation events with return periods exceeding 100 years. The storm of April 19-21, 1973, with precipitation centered in northern Missouri,

is analyzed as a case study. An estimation of evapotranspiration based on relevant meteorological factors indicates a probable reduction of such loss during the flood episode.

This report also contains summaries of stream stages, discharges, and flood volumes for gaging stations where outstanding flood events occurred and includes sediment data where available. The recurrence interval of the event is shown for many of the peaks and volumes. Also included are flood-profile data for the main stem and selected tributary streams.

Keywords: Hydrology, Flow, Sedimentation

CHRISTENSEN, G. M. 1971. Effects of metal cations and other chemicals upon the in vitro activity of two enzymes in the blood plasma of the white sucker, Catastonus commersoni (Lacepede). Chem-Bio. Interact. 4:351-361.

Abstract: Relative changes in the activity of glutamic oxalacetic transaminase (GOT, L-aspartate-2-oxoglutarate aminotransferase) and lactic dehydrogenase (LDH, L-lactate-NAD-oxidoreductase) in blood plasma from white suckers were determined after incubation with 49 compounds, principally inorganic chlorides, at concentrations of the ions up to 2 mg/ml in the reaction mixture. A sequence of inhibitory effect was arranged for each enzyme. Dose-response curves were qualitatively similar for most of the chemicals. GOT was most sensitive to silver and mercury, and LDH to palladium and mercury. Both enzymes are highly inhibited by metals which are highly toxic to aquatic animals. Correlations were studied between the inhibitory effect and certain physiochemical properties of chemicals, the best being found between the inhibition of GOT and the equilibrium constants of metal sulfides.

Keywords: Toxicant, Heavy metals, Fish, Research, White sucker

CHRISTENSON, L. M. 1948. Preliminary report of Mississippi River backwater fish poisoning operations - 1948. UMRCC Invest. Rept. No. 26. 7 p.

Abstract: During the summer of 1948, a fishery survey was made of the Mississippi River. As part of that project, the poisoning-out of two backwater areas was included. The following is a brief report of that phase which operation parallels the fishery investigations of a similar

nature on Miller Lake in 1947, and in the state of Illinois prior to that year.

Keywords: Fish management, Illinois, Backwater

CHRISTENSON, L, M. 1952. Wandering catfish. Wis. Cons. Bull. 17(3):16-18.

Abstract: Because of increasing interest in the channel catfish in recent years, considerable attention of the fish management division has been focused on it. Under the auspices of the Upper Mississippi River Conservation Committee, composed of representatives of the Wisconsin, Minnesota, Iowa, Illinois, and Missouri Conservation departments, an age and rate of growth study of this species in the upper Mississippi has been completed and a tagging study, begun in 1947, is still in progress.

On the basis of information gathered thus far, we came up with the following findings and conclusions pertaining to the channel catfish in the Mississippi River:

(1) There is considerable general movement of channel catfish in the Mississippi, but no distinct upstream or downstream migration tendency is evident.

(2) Individual fish have passed downstream through eight locks and upstream through two locks of the lock and dam installations on the Mississippi, hence these structures do not represent impassable barriers to this species.

(3) Channel catfish are known to have travelled approximately 180 miles in the Mississippi river system, upstream and downstream.

(4) Any one navigation pool on the upper Mississippi is not entirely dependent upon catfish within that particular pool to maintain its catfish population.

(5) There is some indication that the annual catfish harvest in the Mississippi river is small in proportion to the available crop.

(6) Tag returns from fish captured and tagged at Lansing, Iowa and released at Lake City,

Minnesota show that four times as many fish from this lot moved upstream as moved downstream. This disparity is a strong arguement against the homing instinct theory for the channel catfish.

(7) Channel catfish are capable of travelling downstream at a rate of at least 3 miles per day.

(8) The Mississippi may well be an important source of fish for natural maintenance of catfish populations in the tributary rivers.

(9) Because tag returns from releases made in both the spring and the fall of the year showed some comparatively rapid dispersal, movement of the catfish (or at least initial movement in this case) does not appear to be motivated by any spawning instinct.

Keywords: Fish, Catfish

CHRISTENSON, L. M. 1957. Some characteristics of the fish population in backwater areas of the Upper Mississippi River. M.S. Thesis, Univ. of Minn. St. Paul, MN. 125 p.

Abstract: The objectives of this study were to determine the productivity and fluctuations in the populations from year to year, the rate of growth of the common species, and the effects of the navigation-pool draw downs on the fish populations of the backwater areas.

Keywords: Fish, Backwater, Standing crop, Age and growth, Upper Mississippi River, Drawdown, Survey

CHRISTENSON, L. M. 1970. Wisconsin's other sturgeon. Wis. Conserv. Bull. 35(3):10-11.

Abstract: The shovelnose sturgeon is often mistaken to be small lake sturgeon. So little is known about the shovelnose that it is difficult to set regulations for it. Studies now underway should clear up some of the mysteries.

Keywords: Sturgeon, Wisconsin, Fish

CHRISTENSON, L. M. and L. L. SMITH. 1965. Characteristics of fish populations in Upper Mississippi River backwater areas. U.S. Dept. Int., Fish and Wildlife Service, Circular 212, 53 p.

Abstract: Standing crops of fish and their fluctuations from year to year, age and size class structure of the populations, and growth rates of the common species present in three backwater areas of the upper Mississippi River were determined during the period 1947-52 under the auspices of the Upper Mississippi River Conservation Committee.

Standing crops as estimated from six collections following rotenone treatment of blocked-off areas ranged from 39 to 605 and averaged 248 pounds per acre.

Keywords: Fish, Backwater, Survey, Upper Mississippi River, Age and growth, Drawdown, Standing crop

CHRISTIANSON, R. W. 1974. Commercial Navigation on the Upper Mississippi River: An Economic Review of its Development and Public Policy Issues Affecting Minnesota. Minnesota Univ., Minneapolis, Water Resoruces Research and Technology. Washington, D.C. 125 p.

Abstract: Inland waterway transport is a significant carrier of domestic cargo, accounting for about 14% of the total traffic. During the past decade cargo carried by the inland waterways increased by 46% (62% when the Great Lakes are excluded). By increasing the absolute amount of freight carried greater than the average (42%), the inland waterway's relative share of total freight traffic has also grown over the past decade. Also, development of the Upper Mississippi River into a major inland waterway has been even more significant for Minnesota and the Midwest than for much of the rest of the nation. A transportation model, based on competitive assumptions and employing a derived demand analysis, is presented. The model predicts that there will be an increase in demand for transportation services, especially barge services. The current issues in commerical navigation which affect Minnesota involve a resolution of the conflict between developmental and environmental values.

Keywords: Upper Mississippi River, Commercial boat traffic, Ecology, Navigation, Models, Development, Dredging, Minnesota

CHRISTIANSON, R. W. 1975. Commercial Navigation on the Upper Mississippi: Economic and Environmental Choices. Minnesota Univ., St. Paul. Dept. of Agricultural and Applied Economics. Office of Water Research and Technology. Washington, D.C. 8 p.

Abstract: Policy choices facing Minnesota and the Upper Midwest regarding low cost water transportation and environmental values are reviewed. Development of the Upper Mississippi River for commercial navigation is briefly reviewed from a historical viewpoint. The economic role of the wateway is examined. The two court battles over operation, maintenance, and replacement of navigation development are placed in the context of policy choices facing Minnesota and the Upper Midwest.

Keywords: Upper Mississippi River, Commercial boat traffic, Ecology, Navigation, Minnesota

CHURCHILL, E. P., JR. and S. I. LEWIS. 1924. Food and feeding in fresh-water mussels. Bull. U.S. Bur. Fish. 39:437-471.

Abstract: Study of the feeding reactions of and the food required by juvenile mussels.

Keywords: Mussels, Benthos, Food habits

CLAFLIN, T. O. 1973a. Final report: Environmental impact assessment study, Pool 7, of the northern section of the Upper Mississippi River, N. Star Res. Inst., Minneapolis, Minn.

Abstract: The present report covers the entire study program only from January, 1973 through November, 1973. The report contains both historical information and data collected in the field from activities such as water sampling and wildlife observation.

Three aspects of the research approach used in the study are: (1) the benchmark point in time, (2) data collection and analysis on the natural systems, and (3) data collection and analysis on the socioeconomic activities.

Keywords: Pool 7

CLAFLIN, T. O. 1973b. Final report: Environmental impact assessment study, Pool 8, of the northern section of the

Upper Mississippi River, N. Star Res. Inst., Minneapolis, Minn.

Abstract: The studies are designed not only to identify the impacts, but to assess their effects on both the natural and social environment. Such impacts may include effects of river transportation on the area economy, effects of creation of the pools on recreation activities and wildlife habitat, effects of dredge spoil disposal on the natural ecosystem and on recreation, and many others. As a result of identification and assessment of the impacts, it may be possible to suggest ways of operating the facilities and maintaining the navigation and recreation system to amplify the positive and minimize the negative results of the Corps' activities.

Keywords: Pool 8

CLAFLIN, T. O. 1976. Lake Onalaska rehabilitation feasibility assessment report on navigation pool no. 7, Upper Mississippi River. Wis. Dept. Nat. Res.

Abstract: Because of the Mississippi River's vast watershed there appears to be virtually no methods available to alleviate the inflow of materials into the lake, the report said. However, the closure of three of the channels into the lake from the main channel would reduce the sediment inflow into the lake during periods of high flow as well as normal flow periods. This would reduce the amount of sediment that could be trapped and maintained by the lake. Unfortunately this would only be a temporary measure since the transitional areas would become saturated with sediment materials in a few years. Approximately 80% of the total sediment load is carried by the Mississippi River during flood periods. With this consideration, the report recommended that, if water flow were to be controlled, that control gates across the primary feeder channels be installed. Keeping these control gates closed during periods of high flow could divert a major portion of the high sediment load.

Chemically killing the plants is an ineffective means of long-term control, simply because the plants still contribute to the nutrient load of the lake. In essence, the poisoned plants act as a fertilizer for the next years growth.

The lake, with its inherent trapping efficiency, will continue to progress toward a higher eutrophic state unless the hydraulic conditions of the system are radically changed. In addition, at the present time most of the conventional methods of bringing about such change is expensive, and to a certain degree, environmentally unsound.

Keywords: Pool 7, Habitat management, Lake Onalaska

CLAFLIN, T. O. 1977. The Effects of Hydraulic Dredging on the Resuspension and Transport of Sediment Material. In: A Pilot Study on Effects of Hydraulic Dredging and Disposal on Water Quality of the Upper Mississippi River (July 1976). GREAT I Water Quality Work Group. 15 pp.

Abstract: The downstream effects of hydraulic dredging were investigated in Navigation Pool No. 2 in the vicinity of Grey Cloud Slough, on the Upper Mississippi River during July 1976. The general shape of the turbidity plume was determined, as was the approximate distance downstream that the sediments were transported.

The turbidity (NTU) was converted to dry-weight of suspended sediment (mg/l). The most noticeable effects of the dredging activity were noted immediately downstream from the disposal site. The plume was carried into the main channel and was transported in deep water in the channel for a distance of approximately 0.5 miles. Water currents then redistributed the sediment somewhat uniformly through the cross-section of the river in areas further downstream (0.5 mi to 1.2 mi). The suspended solids in the water were significantly higher at least 1.4 miles downstream from the spoil site during the dredging period. An extrapolation of the suspended solid curve indicated that suspended solids remained in the water for a distance of about three miles downstream.

Keywords: Turbidity, Dredging, Pool 2

CLAFLIN, T. O. 1978. Regression Simulation model of navigational Pool 8. UMRCC Annual meeting, Rochester, Minnesota.

Abstract: Statistical methods used to determine the physical and chemical parameters important in controlling densities and distributions of selected organisms in Upper Mississippi River.

Keywords: Models, Pool 8

CLAFLIN, T. O. and S. H. SOMER. 1975. Dredged material revegetation for erosional control. U.S. Army Corps of Engineers. St. Paul Dist.

Abstract: The present study was undertaken to determine whether the dredged material site on Island 117 (Navigation Pool 8) could be vegetated artifically, and whether the climatic, meteorilogical and edaphic conditions were suitable for adequate growth of various species to stabilize the sand from wind and water erosion.

Keywords: Habitat management, Dredging, Vegetation

CLARK, L. H. 1974. Effects of Quad-Cities nuclear station operation on periphytic algae colonizing artificial substrates. Pap. pres. to Miss. River Res. Consortium Ann. Meet. May 17-18.

Abstract: The objective of the periphyton monitoring studies at Quad-Cities Station were to determine the influence of station operation on periphytic algae.

Differences in the community structure and productivity of periphytic algae observed between the intake and discharge bays demonstrate the effects of increased current velocity, elevated temperature and chlorination. Operation of the diffuser pipe discharge system had no effect on periphyton communities at downstream locations.

Differences between periphyton communities on the Iowa and Illinois sides of the river may be attributed to the influence of industrial wastes from Clinton, Iowa and the influence of the Wapsipinicon River.

Keywords: Nuclear power, Periphyton, Illnois

CLARK, S. M. 1974. Determination of the relative state of eutrophy of navigation Pool 7 in the Upper Mississippi River by means of an algal assay procedure. M.S. Thesis, Univ. Wis., LaCrosse, WI.

Abstract: This is an attempt to refine the method to determine eutrophic state of water by application of static bioassay procedure with algae as the test organism. It seemed that Pool 7 was a nutrient trap. Incoming nutrients were assimilated into the abundant plant growth

and then trapped in sediments. Upstream location was significantly greater than downstream sites for NO_3, PO_4 and productivity values. Decay of vegetation is in part responsible for the cyclic nutrient occurrence within the pool.

Keywords: Aquatic plants, Phytoplankton, Research, Pool 7, Methods, Vegetation

CLARKE, A. H., JR. (Ed). 1970. Rare and endangered mollusks of North America. Malacologia. 10:1-56.

Abstract: A list of rare and endangered species with articles included by nine different authors.

Keywords: Benthos, Endangered species

CLEARY, R. E. 1957. A summary report on the Mississippi River creel census. In: Supp. Rept. Fish Tech. sub-Comm., Proc. 13th Ann. UMRCC Mtg. 41-46 pp.

Abstract: A summary of creel censuses which describe species caught, fishing hours, gear used, and fish caught per hour fished.

Keywords: Creel census

CLEARY, R. E. 1958a. Summaries of the 1956 and 1957 exploratory fishing survey in the Mississippi River, LaCrosse, Wisconsin to Burlington, Iowa. Iowa Cons. Comm., Quart. Biol. Repts. 10(3) 3-5

Abstract: The purpose of this report was to abstract the 1956-1957 annual reports. The 3x6 trap net was used as a criterion gear since it was the least selective fixed entrapment device in some of the past surveys (1944, 1946 and 1948).

However, the electric shocker was over 40 times more effective in the per-hour-catch category and nearly as non-selective, averaging 20.2 species per station to the trap nets' 23.6 species per station.

There was a 45:48 ratio of game to commercial species by weight in the Iowa-Wisconsin section of the river (Pools 8-11). In the Illinois-Iowa section this ratio was 29:63 (Pools 12-20).

Keywords: Fish, Survey, Wisconsin, Iowa

CLEARY, R. E. 1958b. Pike tagging program. Progress report on the 1957 pike tagging project on the Mississippi River in vicinity of Guttenberg, Iowa (Mineo.) UMRCC Proceedings 12:161-163.

Abstract: A total of 460 walleyes and 1217 saugers were taken with an electric shocker from the shoal areas below Lock & Dam No. 10 in the vicinity of Guttenberg, Iowa, in April, 1957. From this total, 389 walleyes and 766 saugers, all over 11 inches in total length, were jaw-tagged with #3 Monel metal strap tags and released.

Keywords: Fish, Survey, Distribution, Pike

CLEARY, R. E. 1958c. Notes on the effectiveness of an electrofishing device used in the Mississippi River surveys in Iowa. Iowa Cons. Comm., Quart. Biol. Repts., 10(2):12-15.

Abstract: There was no evidence of latent surfacing of any particular species over another in a study of the catches made by the shocker boat and its accompanying "follow-up" craft. The larger-sized commercial species were, however, slower to come to the surface than any other category or size grouping. In turbid water, the larger-sized game fish were more easily taken than in clear water. This case was reversed with the larger-sized commercial fish. Further comparisons between trapnet and shocker catches were made in 1957 and the shocker and was found to be less efficient in the taking of crappies and white bass, but more efficient in taking buffalo, carp, ang gizzard shad. It also took greater numbers and larger bass and greater numbers and smaller bluegills than the trap net.

Keywords: Fish, Survey, Iowa, Electroshocking

CLEARY, R. E. 1958d. Progress report on walleye and sauger studies in the Mississippi River in Iowa. Iowa Cons. Comm., Quart. Biol. Repts., 10(4):4-5.

Abstracts: Walleye and saugers were tagged in 1957 at Guttenberg, Iowa and in 1958 near New Boston, Illinois and Guttenberg. Recapture data on 1957 tagging suggest annual angler harvest of ten percent on walleyes and seventeen per cent on saugers. Fourteen per cent of the 1958 tagged walleyes were returned by anglers indicating heavier harvest than in 1957. Lack of floods during

migration season is deemed responsible for this increased harvest in 1958. Data on homing and migration are cited based on areas of recapture.

Keywords: Fish, Research, Iowa, Walleye, Sauger

CLEARY, R. E. 1958e. Summaries of the 1956 and 1957 aerial recreational surveys of the Mississippi River in Iowa. Iowa Cons. Comm., Quart. Biol. Repts., 10(3):1-2.

Abstract: The purpose of this paper is to summarize the two annual reports. A series of aerial flights were made over the Iowa waters of the Mississippi River as part of the Federal Aid to Fisheries Project F-24-R-3.

The observer was asked to count the number of fishing boats, boat and bank fisherman, and the number of pleasure craft in each of his assigned pools. Further, during the open-water months of 1957, the Iowa observer was asked to locate, on a series of maps, the presence of each fishing boat and bank fisherman he observed. This procedure served to pin-point areas of angling pressure. This information was later mapped, indicating exact geographical locations and the needs for access areas based on angler concentrations.

It is hoped that through the use of additional flight data a factor can be applied to the lockmaster's daily count and that this figure can be projected into a daily picture of angler utilization of the entire river.

Keywords: Recreational boat traffic, Iowa

CLEARY, R. E. 1959. Summary of investigational shocking on the Mississippi River in the vicinity of Lansing, Iowa, 1958. Iowa Cons. Comm., Quart. Biol. Repts., 11(4):12-18.

Abstract: During the summer of 1958 attempts were made to determine one or more physical or climatic factors affecting the effectiveness of the electric shocking device used in inventorying Iowa's stream fishes. Relationships between size of catch (numbers) and water and air temperatures, turbidity, electrical resistance, cloud cover, wind direction and velocity, and time of day were noted and for the most part proved negative. A direct relationship between catch and water temperature was the most apparent.

Various types of electrodes (grids) were treated under various conditions and habitats and a piece of copper coated rod or weighted copper tubing proved the most efficient. The length and size of the rod purely a matter of choice or convenience.

Keywords: Fish, Survey, Iowa

CLEARY, R. E. 1960. Tagging program: 1959 pike tagging on Mississippi River at Guttenberg, Iowa, with notes as to 1957 and 1958 recaptures. (Mimeo.) UMRCC Proceedings, 16:125-126.

Abstract: A three-year-walleye and sauger tagging project was initiated on the Iowa portion of the Mississippi River in April, 1957.

The basis for this project was to determine: (1) angler exploitation; (2) movement and migration; (3) salient life history features of these large river pike populations.

Keywords: Fish, Distribution, Iowa, Pike

CLEARY, R. E. 1961a. Mississippi fish from a statistician's viewpoint. Iowa Conserv. 20(6):143.

Abstract: A compilation of fisheries statistics for four years work describing where fishermen come from to fish, how many trips a week, cost of fish, and what kind of fish can be caught.

Keywords: Fish, Distribution, Statistics

CLEARY, R. E. 1961b. Miscellaneous Mississippi River investigations. Iowa Cons. Comm., Quart. Biol. Repts., 13(2): 1-3.

Abstract: A cpmparison between quantitative and qualitative types of creel census on the river indicated that the pre-designed method of contracting anglers resulted in a catch estimate reduction of 26% when compared to the results from an "undisciplined" census of the same waters.

In comparing catches made in "stiffened" and "soft" nylon trap nets, it was determined that more and larger commercial species are taken in "soft" nets, while, conversely, greater numbers of larger sport

fish were taken in the treated nets. Practical ramifications being that not only will commercial operators benefit themselves by using "soft" nets but also will be less "bothered" with handling game fish.

Keywords: Survey, Fish

CLEARY, R. E. and J. GREENBANK. 1954. An analysis of techniques used in estimating fish populations in streams, with particular reference to large non-trout streams. J. Wildl. Manage. 18(4):461-476.

Abstract: A substantial amount of work has been done in North America in estimating fresh-water fish populations; but to date the emphasis largely has been upon lakes, ponds, and upon trout streams or small warm-water streams. Relatively little attention has been given to larger rivers, partly because they present greater difficulties.

Keywords: Fish, Population

COFFEY, P. J. and J. M. RADEMACHER. 1962. Report of Water Quality Survey of Mississippi River from Clinton, Iowa, to Rock Island, Illinois, Sanitary Engineering Center, Cincinnati, Ohio 63 p.

Abstract: The Mississippi River reach below Clinton, IA, has a history of reported pollution extending back to 1943. The report includes a field survey of water quality conducted between October 23 and 31, 1961, in the 40-mile reach of the Mississippi from Dam 13 to Dam 15, with particular reference to bacterial concentrations, dissolved oxygen content, and biological indicators of pollution.

Keywords: Pollution, Water quality, Dam, Bacteria, Iowa, Illinois, Pools 13-15

COKER, R. E. 1914. Water-power development in relation to fishes and mussels of the Mississippi.

Abstract: Points out the complexity of the problems involved in the effect of water-power development upon fisheries and the mussels.

Keywords: Fish, Mussels, Nuclear power

COKER, R. E. 1916. The utilization and preservation of fresh-water mussels. Trans. Am. Fish. Soc. 46(1):39-46.

Abstract: Existence and commercial abundance are primarily concentrated in American waters. The mussels are the basis of significant fishery and manufacture, especially for buttons. Naturally self-perpetuating and therefore supply will not be exhausted. Protection has been found to be needed in areas of high industry.

Keywords: Fish, Iowa, Research

COKER, R. E. 1919. Fresh-water mussels and mussel industries of the United States. Bull. U.S. Bur. Fish. Washington, Vol. XXXVI. p. 13-89.

Abstract: Discusses the commerical fresh-water mussels (qualities of their shells and varieties of commerical shells) and the fresh-water mussel fishery (value and extent of the fishery, depletion of mussel resources, apparatus and methods of fishing).

Keywords: Mussels, Industry, Shells

COKER, R. E. 1921a. The fisheries biological station at Fairport, Iowa. Appendix I, Rept., U.S. Comm. Fish. for 1920. pp. 3-12.

Abstract: A description of the fisheries biological station in Fairport with discussion of its history, functions, personnel, equipment and service rendered.

Keywords: Fish, Iowa, Research

COKER, R.E. 1921b. Freshwater mussel industry. Rept. of U.S. Comm. Fish., Washington, 1917-18, p. 39.

Abstract: A description of the mussel industry in the United States with much reference to those of the Mississippi River.

Keywords: Mussels, Industry

COKER, R. E. 1929. Keokuk Dam and the fisheries of the Upper Mississippi River. Bull. U.S. Bur. Fish. Separately

issued as Bur. of Fish. Document No. 1063, 45:87-139.

Abstract: This is a study of the changes in fishes due to the leveling of river banks and dredging and straightening of river channels. The dam acts as an effective barrier to upstream movements of fish.

Keywords: Dredging, Dam, Habitat, Fish, Migration, Channelization

COKER, R. E. 1930. Studies of common fishes of the Mississippi River at Keokuk, Bull. U.S. Bur. Fish. 45:141-225.

Abstract: A study of the habits of commn fishes of the area, by species.

Keywords: Dredging, Dam, Habitat, Fish, Migration, Channelization

COKER, R. E., A. F. SHIRA, H. W. CLARK and A. D. HOWARD. 1921. Natural history and propagation of fresh-water mussels. Bull. U.S. Bur. Fish. 37:77-181. Separately issued as Bur. Fish. Document No. 893.

Abstract: Discussion of natural history of fresh-water mussels including; habitats, food of mussels, habits, parasites and enemies, conditions unfavorable for mussels, and growth and formation shell. Life history and propagation of fresh-water mussels and structure of fresh-water mussels are also described.

Keywords: Mussels, Reproduction, Age and growth, Parasites

COLBERT, B. K., J. E. SCOTT, H. JOHNSON, and R. C. SOLOMON. 1975. Environmental Inventory and Assessment of navigation Pools 24, 25 and 26, Upper Mississippi and Lower Illinois Rivers. An Aquatic Analysis. Army Engineer Waterways Experiment Station, Vicksburg, MS. 368 p.

Abstract: The purpose of the report was to establish a data base for the physical, chemical, and biological components of the aquatic system in Pools 25, 25 and 26 on the Upper Mississippi and Lower Illinois rivers. Four major habitats were sampled--49 sites at 13 transects on the Lower Illinois River. habitats sampled were the main channel, side channel, river border areas, and areas downstream of dikes. Water and sediment samples were collected for physical and chemical characterization. In situ measurements were made for dissolved

oxygen, temperature, total alkalinity, pH, turbidity units, and settleable solids. Laboratory analyses were made of water and sediment samples for chemical oxygen demand, phenols, heavy metals, selected nutrients, and chlorinated hydrocarbons. Benthic organisms, drift organisms, phytoplankton, and zooplankton were collected from the Illinois River only. The data collected were subjected to various statistical analyses to test for differences between dates and among habitats and between rivers. The environmental impacts of operation and maintenance activities on the aquatic system are discussed.

Keywords: Fish, Dam, Illinois River, Upper Mississippi River, Turbidity, Benthos, Chemistry, Phytoplankton, Zooplankton, Pools 24-26, Main channel, Side channel

COLBERT, B. K., J. E. SCOTT, J. H. JOHNSON and R. C. SOLOMON. 1976. Environmental inventory and assessment of navigation Pools 24, 25 and 26 Upper Mississippi and Lower Illinois Rivers: an aquatic analysis. USACE Waterways Experiment Station, MS. Final Rept. COL002.

Abstract: An attempt was made to establish a data base for the physical, chemical, and biological components of the aquatic system in Pools 24, 25 and 26 on the Upper Mississippi and Lower Illinois rivers. Four major habitats were sampled: 49 sites at 13 transects on the Upper Mississippi River, and 21 sites at 6 transects on the Lower Illinois River. Habitats sampled were the main channel, side channel, river border areas, and areas downstream of dikes. In situ measurements were made for DO, temperature, total alkalinity, pH, turbidity units, and settleable solids. Laboratory analyses were made of water and sediment samples for COD, phenols heavy metal, selected nutrients, and chlorinated hydrocarbons. Benthic and drift organisms, phytoplankton, and zooplankton were also collected during sampling periods.

Keywords: Illinois River, Upper Mississippi River, Temperature, Turbidity, Benthos, Chemistry, Phytoplankton, Zooplankton, Sediment, Pools 24-26, Habitat, Ecology, Main channel, Side channel, Dike, Heavy metals, Water quality, Chlorinated hydrocarbons

COLE, L. J. 1905. The German carp in the United States. Rept. of the Bur. of Fish. - 1904. Dept. Commerce and Labor. 523-642 pp.

Abstract: An investigation was made of the habits of the carp and to gather any available information relative to its usefulness or obnoxiousness. Results shown that the carp does considerable damage, but this is offset by its value as a food fish and in other ways.

Keywords: Carp, Fish, Behavior

COLLINGSWORTH, R. F. 1973a. Final report: environmental impact assessment study, Pool 1, of the northern section of the Upper Mississippi River. N. Star Res. Inst., Minneapolis, MN.

Abstract: The purpose of the environmental impact study is to assess the impacts, both positive and negative, of the construction and operation and maintenance of the Corps' nine-foot channel project on the Northern Section.

The studies are designed to identify the impacts and to assess their effects on both the natural and social environment. Such impacts may include effects of river transportation on the area economy, effects of creation of the pools on recreational activities and wildlife habitat, effects of dredge spoil disposal on the natural ecosystem and on recreastion, and many others.

Keywords: Pool 1

COLLINGSWORTH, R. F. 1973b. Final report: environmental report assessment study, Pool 2, of the northern section of the Upper Mississippi River. N. Star Res. Inst., Minneapolis, MN.

Abstract: The overall objectives of this report are to identify and provide an assessment of the impacts of the Corps of Engineers activities related to Pool 2. Specifically, following this section, the report is in the format required for the Environmental Impact Statement, and seeks:

1. To identify the environmental, social, and economic impacts of the Corps' activities related to Pool 2.

2. To identify and, where possible, measure the beneficial contributions and detrimental aspects of these impacts and draw overall conclusions about the net effect of Corps' activities.

3. To recommend actions and possible alternative methods of operations that should be taken by the Corps of Engineers and other public agencies and private groups to reduce detrimental aspects to the project.

4. To identify additional specific research needs to assess the impacts and increase the net benefits of Corps operations.

The report includes an analysis of natural and socio-economic systems. The natural systems include terrestrial and aquatic plant and animal life as well as the nature of the land and quality of the water. Socio-economic systems include industrial activities, such as income and employment generated by barge traffic or activities in operating the locks and dams and commercial fishing; recreational activities, such as fishing, boating, or hunting that are affected by Corps' operations; and cultural considerations, which include archaeological and historical sites.

Keywords: Pool 2

COLLINGSWORTH, R. F. 1973c. Final report: environmental impact assessment study, St. Croix River Pool, of the northern section of the Upper Mississippi River. N. Star Res. Inst., Minneapolis, MN.

Abstract: The present report deals only with the St. Croix River from Stillwater, Minnesota, downstream to its mouth.

The report includes an analysis of natural and socio-economic systems. The natural systems include terrestrial and aquatic plant and animal life as well as the nature of the land and quality of the water. This includes the habitats of rare and endangered species and tracts of special value for environmental education.

Keywords: St. Croix River

COLLINGSWORTH, R. F. 1973d. Final report: environmental impact assessment study, upper and lower St. Anthony Pools, of the northern section of the Upper Mississippi River. N. Star Res. Inst., Minneapolis, MN.

Abstract: The studies are designed to identify the impacts and to assess their effects on both the natural and social environment. Such impacts may include effects of river

transportation on the area economy, effects of creation of the pools on recreational activities and wildlife habitat, effects of dredge spoil disposal on natural ecosystems and on recreation, and many others. As a result of identification and assessment of the impacts, it will be possible to determine ways of operating the facilities and maintaining the navigation and recreation system to amplify the positive and minimize the negative results of the Corps' activities. The study will provide a comprehensive basis for the St. Paul District to prepare an environmental impact statement in the compliance with the National Environmental Policy Act of 1969 and the policy of the U.S. Army Corps of Engineers.

Keywords: St. Anthony Falls

COLLINGSWORTH, R. F., B. J. R. GUDMUNDSON, W. L. K. SCHWARZ and C. W. RUDELIUS. 1973. Environmental impact assessment study: St. Anthony Falls Upper and Lower pools, Pool 1, Pool 2, and lower 25 miles of the St. Croix and Minnesota rivers. North Star Research Inst., Minneapolis, MN. 164, 188, 211, 141 and 169 p., respectively.

Abstract: The report includes an analysis of natural and socio-economic systems. The natural systems include terrestrial and aquatic plant and animal life as well as the nature of the land and quality of the water.

Socioeconomic systems include industrial activities, such as income and employment generated by barge traffic or activities in operating the locks and dams and commercial fishing; recreational activities, such as fishing, boating, or hunting that are affected by Corps operations; and cultural considerations, which include archaeological and historical sites.

Keywords: Limnology, Pool 1 and 2, St. Croix River, Minnesota River

COMAR, R. A. 1967. Food habits of various species of game fish from the Upper Mississippi River Pool 6 with particular reference to the importance of gizzard shad, Dorostoma cepedianum, as a forage fish. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: During the summer of 1966, nine game fish species (Pomoxis nigromaculatus, Ictalurus punctatus, Esox lucius, Micropterus salmoides, Micropterus dolomieui,

Mabloplites rupestris, Stizostedion canadense, Stizostedion vitreum, and Roccus chryops) were collected with the aid of a 230 volt AC shocker, from the Upper Mississippi River, Pool 6, in the vicinity of Winona, Minnesota. The stomach contents of 501 fish were removed by a stomach pump, and analyzed microscopically. It was found that the gizzard shad was not utilized to any great extent. Mayflies (Ephemeroptera) and water boatman (Corixidae) were the chief insect food of saugers, black crappies, and smallmouth bass. Walleyes and channel catfish utilized mayflies to a great extent; walleyes, saugers and largemouth bass preyed on young-of-the-year largemouth, smallmouth, and white bass to some extent. Black crappies, largemouth bass and white bass utilized crustaceans to a considerable degree. There was a variation in the diet of black crappies, largemouth bass, smallmouth bass and walleye. The smallmouth bass diet is compared with their eating habits in four other streams. Walleyes and saugers, white bass and smallmouth bass show a high correlation between their diets.

Keywords: Food habits, Fish, Pool 6, Gizzard shad

CONLEY, L., S. SATRE and R. SPARKS (eds.). 1974. Iowa fishing guide. Ia. Cons. Comm., Des Moines. 31 pp.

Abstract: All of Iowa's public fishing lakes of 10 acres or more are listed in this guide with information on location, water description, major and minor fish species present, and up-to-date facts on camping and boating opportunities. These waters are listed regionally by fish management district.

Iowa's major streams are also described with public access areas listed along with boat ramp and camping information. Major fish species occurring in each stream are listed with hints on how to improve the take of these fish.

Stories have also been prepared about special area angler opportunities such as fishing in border rivers, large impoundments, farm ponds, ice fishing and Iowa's trout program. Iowa's fish hatcheries and experimental shocking program are described.

Keywords: Iowa, Fishing

COON, T. G., J. W. ECKBLAD, and P. M. TRYGSTAD. 1977. Relative abundance and growth of mussels mollusca (Eulamellibranchia in Pools 8, 9 and 10 of the Mississippi River. Iowa, USA. Fresh. Biol. 7(3):279-286.

Abstract: Twenty-three species of unionid mussels were sampled during the summer of 1975 from a 76-mile reach of the Upper Mississippi River; this represented eight species fewer than were recorded in 1930-31 survey for the same section of the river. Of the 244 sites sampled in 1975, mussels were found at 116 sites and the ten most productive sites accounted for 40.8% of the 1205 mussels collected. The two most abundant species (Amblena peruviana and Megalonaias gigantea) constituted 54.5% of the mussels sampled in 1975; these two species made up only 8.3% of the 1930-31 survey. Individuals of the twelve most abundant mussel species were aged, and shell-length growth equations were determined. In additon, shell-free dry weight growth rate and shell weight growth rate was determined for Amblema peruviana.

Keywords: Mussels, Pools 8-10, Iowa, Ecology, Distribution

COOPER, W. S. 1855. List of shells collected by Mr. Schoolcraft, in the western and northwestern territory. In: H. R. Schoolcraft, summary narrative of an explanatory expedition to the sources of the Mississippi River, in 1820: resumed and completed, by the discovery of its origin in Itasca Lake, in 1822. 515-518 pp. Lippincott, Grambo, and Co., Philadelphia

Abstract: A list of shells found by Schoolcraft on his expedition to the sources of the Mississippi River.

Keywords: History

COOPER, W. S. 1935. The history of the Upper Mississippi River in late Wisconsin and post-glacial time. Minn. Geol. Survey, Bull. 26.

Abstract: An historical survey of Mississippi during glacial times with a discussion of the Wisconsin period and dunes.

Keywords: History, Upper Mississippi River

COPP, J. M. 1967. Growth study of the young gizzard shad (Dorostoma cepdianum) in the Upper Mississippi River.

B.A. Thesis, St. Mary's College, Winona, MN. 22 p.

Abstract: Young gizzard shad, Dorosoma cepedianum, were collected in the Upper Mississippi River during the autumn months of the year 1966. A total of 15 collections were made during this time by means of an electrical shocking apparatus. The environmental conditions were noted and recorded, namely, the water temperature, water current, depth of water, type of bottom, and type of habitat. According to the data compiled, it was concluded that the gizzard shad, Dorosoma cepedianum, were found at a shallow depth inhabiting a mud and weed bottom. A low water temperature affected the gizzard shad by forcing them from shallow to deeper waters. It was found that the growth rate of the gizzard shad in the Upper Mississippi region is greater than that of the Lake Erie region, equal to that of the Illinois River, and less than that of the Indiana lakes. During the autumn months, the weight and length of the shad in the Upper Mississippi waters is relatively independent of the age.

Keywords: Age and growth, Fish, Gizzard shad

CORCORAN, E. F. 1973. Gas-chromatographic detection of phthalic acid esters. Environ. Health Perspect. 3(3):13.

Abstract: A program of study designed to measure the concentration of trace metals and chlorinated hydrocarbon pesticides in the effluents of the Mississippi River and esturaries of the northeastern Gulf of Mexico was begun in 1970. Some results of this program will be discussed in this report. During April and May 1970 samples of water, suspended material, sediments and benthic organisms from the Mississippi River, delta system and adjacent Gulf of Mexico were collected for chlorinated hydrocarbon pesticide anslyses. A total of 42 stations were occupied.

Keywords: Chlorinated hydrocarbons, Chemistry

CORSENTINO, J. S. 1976. Projects to Expand Fuel Sources in Western States. Survey of Planned or Proposed Coal, Oil Shale, Tar Sand, Uranium, and Geothermal Supply Expansion Projects, and Related Infrastructure, in States West of the Mississippi River. Bureau of Mines, Denver, Colo. Intermountain Field Operation Center.

Abstract: This report is a listing of fuels-related projects that

are presently under construction, planned, or proposed by various companies and organizations in the Western United States. The future facilities covered fall into the following categories: coal mines and expansions to existing mines, electric powerplants and waste-to-fuel conversion plants, oil shale projects, tar sands projects, potential geothermal facilities, coal slurry pipelines, railroads related to fuels development, uranium mines and enrichment facilities, oil refineries, and natural gas processing plants.

Keywords: Mining, Power, Development

COUCH, L. K. 1946. Effects of DDT on wildlife in a Mississippi River bottom woodland. Trans. N. Am. Wildl. Conf. 11:323-329 p.

Abstract: Applications of DDT in the outdoord, whether on marshes, lakes, streasm, on crop and pasture lands and in forested areas, present a serious threat to fish and wildlife species. This paper covers observations before and after extensive applications of DDT on forested lands along the Mississippi River.

Keywords: Pesticides, Wildlife

COUES, E. (Ed.). 1893. History of the expedition under the command of Lewis and Clark, 4 vol., Francis P. Harper, New York.

Abstract: A history of the Lewis and Clark expeditions to the sources of the Missouri River with field notes of the two explorers describing all their journeys.

Keywords: History

COX, U. O. 1896. A report on the fisheries of southwestern Minnesota. Rept. U.S. Comm. Fish and Fisheries Pt. 20 (1894), pp. 605-616.

Abstract: Collections of fish from the Minnesota and Blue Earth rivers and their tributaries to study the run of the buffaloes and suckers. A descriptions is also given of a new species of Luceiscus from the Upper Mississippi River Basin in Minnesota.

Keywords: Fish, Minnesota

CREVENSTEN, D., A. STODDARD, and G. VAJDA. 1973. Water Quality Model fo the Lower Fox River, Wisconsin. United States Environmental Protection Agency. Enforcement Divison. EPA-905-73-001. 61 pp.

Abstract: A mathematical model describing the interrelationship between the dissolved oxygen concentration of a river and its various sources and sinks has been adapted for use in a study of the Lower Fox River in Wisconsin. The analysis assumes steady-state conditions and describes the longitudinal distribution of dissolved oxygen in the river for, Neenah-Menasha to Green Bay, a distance of approximately 40 miles (64.4 km).

The model was verified for various conditions of waste loading, river temperature, and river flow. The model was then used to evaluate the effect on water quality of implementing interim best practicable control technology effluent limitations for industrial discharges and 90 percent BOD removal from municipal waste sources, as an estimate of levels of treatment required by the 1972 Amendments to the Federal Water Pollution Control Act and by orders issued by the Wisconsin DNR, respectively. The study indicated that implementation of the above effluent limits will result in a significant improvement in water quality in the Lower Fox River. A daily average dissolved oxygen concentration of 4 to 5 mg/l will be maintained under most flow conditions. During an extreme low flow and high temperature situation, the dissolved oxygen concentration could drop to 2 to 3 mg/l

Keywords: Wisconsin, Fox River, Water quality, Models, Effluent

CROHURST, H. R. 1932. A study of the pollution and natural purification of the Upper Mississippi River. Surveys and laboratory studies. Public Health Service, Washington, D.C. (291 300)

Abstract: The report, therefore, contains data relative to the physical features of the Upper Mississippi River watershed and the river channel; summaries of total and sewered population, with estimates of sewered population equivalent to the industrial waste pollution; estimates of discharge and times of flow; and a summary of the chemical and bacteriological findings at various points on the section of the river under investigation. These data are presented in a series of basic tabulations, condensed to the form of monthly averages, with a discussion of the salient features of each.

Keywords: Pollution, Water quality

CRUMP-WIESNER, H. J., and A. L. JENNINGS. 1975. Properties and effects of nonpetroleum oils. Presented at EPA/API/USCG Conf. on Prevention and Control of Oil Pollution, San Francisco, March 25-27, 1975, (4) 29 p.

Abstract: About 5% of the spilled oil reported to EPA is from nonpetroleum oils. The properties, behavior, and effects of petroleum and nonpetroleum, oils in the aquatic environment are compared. The two types of oils are strikingly similar. Case histories of the Minnesota and Mississippi Rivers, Los Angeles Harbor, and New York State waters are presented. Guidelines for distinguishing between oils and other hazardous substances are presented for enforcement purposes.

Keywords: Pollution, Minnesota River, Water quality, Discharge, Effluent, Chlorinated hydrocarbons, Chemistry

CULLER, C. F. 1930. Depletion of the aquatic resources of the Upper Mississippi River and suggested remedial measures. Trans. Am. fish. Soc. 60:279-283.

Abstract: In this paper the writer is discussing certain problems affecting the fisheries of the Upper Mississippi River. These problems are of vital importance to the general public because of the Federal Upper Mississippi Wildlife and Fish Refuge being included in this area and because of plans of the government to provide a nine-foot channel through this part of the river, thereby changing the river in a sense into a series of pools behind dams in the interests of navigation.

The three major problems affecting aquatic life within the boundaries of the Upper Mississippi River Wildlife and Fish Refuge may be summarized under three general headings: 1. Pollution. 2. Erosion. 3. Fluctuation of water levels.

Keywords: Pollution, Habitat management, Upper Mississippi River

CULLER, C. F. 1934. The future of the Upper Mississippi fisheries. Trans. Amer. Fish. Soc., 64: 328-331.

Abstract: The following recommendations are made for the benefit of the health, recreation and prosperity of all the people:

1. Reclaim and reforest drained areas.
2. Correct silt erosion.
3. Cleanse the streams by eliminating both trade wastes and domestic sewage.
4. Conserve our flood waters by the creation of large retaining pools where conditions warrant.
5. Survey and improve all open waters, including lakes, streams and impounding waters.

Keywords: Fish, Upper Mississippi River

CULLIMORE, D. B. 1971. Corps vs. Conservationists, battle for Upper Mississippi. Izaak Walton Mag. (2). p. 8.

Abstract: Due to towboats and heavily laden barges the Corps of Engineers is proposing to deepen the Upper Mississippi from 9 feet to 12 feet. This would enable year-around navigation, bigger barge town, more industries and commerce, a greater need for flood control and more work for the U.S. Army Corps of Engineers. Environmentalists point out all the wildlife habitat which would be destroyed.

Keywords: Upper Mississippi River, Channelization, Commercial boat traffic, Recreational boat traffic

CUNNINGHAM, J. C. 1977. The Long Tow Technology: Its impact on the Lock-served reach of the Upper Mississippi River system. 101 p.

Abstract: An analysis of field data from Lock & Dam 26 relevant to locking capacity. It concludes that the Upper Mississippi River system development could more wisely be based on expanding navigation capacity by matching tow sizes with present lock sizes.

Keywords: Tow, Lock and Dam 26

CURRY, L. L. 1962. A study of the ecology and taxonomy of freshwater midges (Diptera: Tendependidae). Central Michigan University, Mount Pleasant, Michigan. 149 pp.

Abstract: Midges of Michigan with special reference to their role in the "turnover" of radioactive substances in hydrosolution.

Keywords: Invertebrates, Ecology, Midges, Taxonomy

CURTIS, J. T. 1950. The vegetation of Wisconsin. Univ. of Wis. Press, Madison.

Abstract: The general plan consists of several introductory chapters on the flora, the environment, the nature and distribution of the vegetation, and the methods employed in the study. These are followed by a number of chapters which take up single communities or groups of communities. These employ a relatively standardized of the particular community. In these chapters the openings include maps showing the locations of the communities studied. For the convenience of the reader many of these maps are in the Appendix as well. In each there is an account of location, size, composition, environmental relations, geographical relations, and current use. The supporting tabular data are gathered together at the end of the book along with a brief community summary. The recent geological history of the vegetation and the influence of man are discussed in two further chapters.

Keywords: Vegetation, Wisconsin

CVANCARA, V. A. 1975. Studies on the Tolerance of Young-of-the-Year Mississippi River Fish to Heated Waters. Wisconsin Univ., Eau Claire, Dept. of Biology. Office of Water Research and Technology, Washington, D.C.

Abstract: An attempt was made to simulate in the laboratory, Mississippi River water conditions in a one way flow experimental chamber to determine the temperature tolerance of young-of-the-year fish. The parameter was cho sen to simulate the environmental conditions that young fish would face in their natural hatching areas when confronted with an actual thermal plume as from the effluent of a large nuclear electricity generating plant. It appears that these young fish during short periods of peak summer temperatures would suffer some heat stress normally and the problem would be compounded if heated effluents were added to the river during periods of high summer temperature.

Keywords: Research, Thermal effluent, Habitat, Temperature, Flow, Fish, Minnesota

CVANCARA, V. A., S. F. STIEBER, and B. A. CVANCARA. 1977. Summer temperature tolerance of selected species of Mississippi River acclimated young of the year fishes. Comp. Biochem. Physiol. a Comp. Physiol. 56 (1): 81-85.

Abstract: The main goal of the following research was to measure the lethal effects of elevated water temperatures on natural immature fish during summer periods of July and August. It is during this time that the ambient water temperature of the river is already high for the season and increasing the water temperature may prove to ve very stressful to the larval aquatic animal. An attempt was made to simulate natural river conditions that would be faced by the aquatic organism if water temperatures were increased.

Keywords: Fish, Temperature, Ecology, Habitat management, Physiology

CZAJKOWSKI, G. P., and G. F. CARPENTER. 1974. Unpublished. Seasonal abundances of zooplankton in the Mississippi River near Cordova, Illinois.

Abstract: Zooplankton samples were collected from channel and slouth locations in the Mississippi River near Cordova, Illinois, spring through fall of 1972 and 1973. Densities were found to be inversely related to river flow conditions while the species richness observed on a particular sampling data was directly related to flow. The zooplankton sommunity was dominated by several true planktonic species which were present throughout the study such as Cyclops vernalis, Cyclops bicuspidatus thomasi, Diaptomus siciloides, and Bosmina longirostris. Additional dominant taxa were total Rotifera and the tychoplankter Chydorus sphaericus. Other species such as Diaphanosoma spp. and Moina spp. demonstrated seasonal pulses. The remaining species observed could be catagorized as incidental forms which were present as a result of fluctuating flow conditions.

Data for stomach analysis of two fish species collected in the study area indicate that selection of zooplankton in the channel is based upon size, visibility, and relative abundance of the zooplankton species. Preference for zooplankton in slough habitats appears to be based primarily upon abundance.

Keywords: Food habits, Zooplankton, Flow

DAGGY, R. H. 1945. New species and previously undescribed naiads of some Minnesota Mayflies (Ephemeroptera). Ann. Entomol. Soc. Am. 38:373-396.

Abstract: Detailed description (external morphology) of new forms of naiads and ones previously unknown.

Keywords: Invertebrates, Minnesota, Taxonomy, Mayflies

DALEY, S. A. and J. SKRYPEK. 1964. Angler creel census of Pools 4 and 5 of the Mississippi River, Goodhue and Washington Counties, Minnesota, in 1962-63. Minn. Fish. Invest. Rept. 277. 49 p.

Abstract: These pools were fished mostly by residents of the counties bordering on this river area. Pool 4 anglers fished from small boats but Pool 5 anglers fished from commercially operated barges. Natural bait was most popular. Average catch rate was one fish per man per hour. Crappie, bluegill, white bass and sauger were most common fish.

Keywords: Creel census, Pools 4 and 5

DANIEL, C. and R. LAMAIRE. 1974. Evaluating effects of water resource developments on wildlife habitat. Wildl. Soc. Bull. 2:114-118.

Abstract: A system is presented for evaluating effects of water resource development projects on wildlife habitat, based upon existing habitat values rather than on man's utilization of wildlife. Effects of water resource projects on wildlife habitat are summarized numerically, and unique habitat types and endangered fauna or flora are considered. Credit can be given for project benefits as well as losses. The amount of mitigation needed is determined by the same evaluation procedures. The basic philosophy of the system is that all land has an existing wildlife habitat value that can be expressed numerically.

Keywords: Wildlife, Habitat

DAWLEY, C. 1947. Distribution of Aquatic Mollusks in Minnesota. Amer. Midl. Nat. 38: 671-497.

Abstract: Distribution of aquatic mollusks in Minnesota both geographical and ecological. Geographical distribution

according to drainage system and largely concerned with the effects of physical barriers on the migration of the mussels. Ecological distribution concerned with the effect on the distribution of both mussels and snails of the various sets of environmental conditions that are found within the boundaries of any one drainage system.

Keywords: Benthos, Distribution, Minnesota, Mollusks

DAYTON, R. B. 1976. Analysis of Bridge Collision Incidents. Operations Research Inc., Silver Springs, Maryland. 377 p.

Abstract: This report is the investigation of towboat collisions with bridges on the inland waterway and western rivers. Volume I was a review and analysis of casualty reports. Volume II supplements and completes the casualty research by technical interviews with experienced towboat captains and pilots. The primary cause of bridge collisions is identified as lack of control in high water and swift currents. Five bridges are studied in detail including navigation procedures for making the bridge passage safely.

Keywords: Commercial boat traffic, Flooding, Tow, Navigation

DE COOK, R. and R. E. CLEARY. 1960. Fishing gear evaluation, Mississippi River - 1960. Iowa Cons. Comm., Mimeo., Unpublished. 5 p.

Abstract: A change in trap-net construction and mesh size occurring prior to the 1960 netting season necessitated a catch comparison being made to adjust survey data collected prior to that time in "old style" trap nets. The change was from 1 3/6" mesh cotton nets to 1 1/2" mesh nylon nets. Comparisons were between catches in 4 catagories. Sports fish, commercial fish, predatory fish, and forage fish. Differences in catch were due to mesh size.

"Stiffened" and soft nylon nets were also compared in the 4 catagories. There was little, if any difference in predatory and forage fishes. Commercial fish were caught more frequently and were heavier in soft nets; sports fishes were caught more frequently and were heavier in "stiffened" nets.

Keywords: Fishing, Equipment

DE COSTA, J. 1964. Latitudinal description of Chydorid Cladocera in the Mississippi Valley, based on their remains in the surficial lake sediments. Invest. Ind. Lakes and Streams 6(2).

Abstract: This study was undertaken to define the latitudinal distribution of the Chydoridae in the Mississippi Valley by quantitative means. Data from 45 lakes covering an area from Lake Itasca, Minnesota, to New Orleans, Louisiana were used. The remains the chydorids leave in lake sediments were identified and the relative abundance (percentage) of the remains of each species in each lake determined. Chydorus sphaericus was the single most abundant species in most lakes.

Keywords: History, Zooplankton

DE COSTA, J. 1968. Species diversity of chydorid fossil communities in the Mississippi Valley. Hydrobiologia. 32(3-4). 497-572.

Abstract: The present paper is an attempt to describe the species diversity of the chydorid fossil fauna found in 45 lakes in the Mississippi Valley. The collections were originally made for a distributional study (De Costa, 1964) but since Goulden (1964a, b) was able to show that the chydorid fossils recoverable from lake sediments may tend to fit the MacArthur Type I species abundance distribuion, it was thought that a reexamination of the already existing data in these terms would be fruitful.

Keywords: Invertebrates, History, Survey, River lake, Zooplankton

DEEGEN, U. F. 1972. Applied mathematical modeling of the oxygen distribution in a Mississippi stream. M.S. Thesis, Univ. So. Miss, Hattiesburg, MS. 75 p.

Abstract: The mathematical model presented was designed to accept data for the various sources of dissolved oxygen and biological oxygen demand accounting for the various inputs and outputs of the aquatic system. It represents a compliation of existing programs: like other methods of this type, the basic equation is that of Streeter and Phelps. The program proved to be fundamentally sound and workable by yielding accurate results with hypothetical problems as well as with the actual stream survey.

Keywords: Pollution, Models, Temperature, Chemistry

DEES, L. T. 1961. Sturgeons. Fish. Lflt. No. 526. 8 pp.

Abstract: Sturgeons are strange appearing fish. All are armored like the knights of old. Some individuals are gigantic; one species may reach a length of 16 feet and a weight of more than a ton. The mouth can be protruded to a remarkable extent, and the upper lobe of the uneven tail is much larger and longer than the lower one.

Sturgeons occur in the seas, estuaries, and rivers of northern Europe, Asia, and North America, but not in the tropics or in the southern hemisphere. They are of commercial value wherever found. The commercial catch of sturgeon in the United States during the 10-year period 1949-58 varied from a low of 453,000 pounds in 1951, worth $110,000 to 819,000 pounds in 1956, worth $144,000. The average landings and value during that period were 657,000 pounds and $127,200.

Keywords: Sturgeon, Fish

DEGENHARDT, E. A. 1973. Channel stabilization of the middle Mississippi River. M.S. Thesis, Colorado State Univ., Fort Collins, CO.

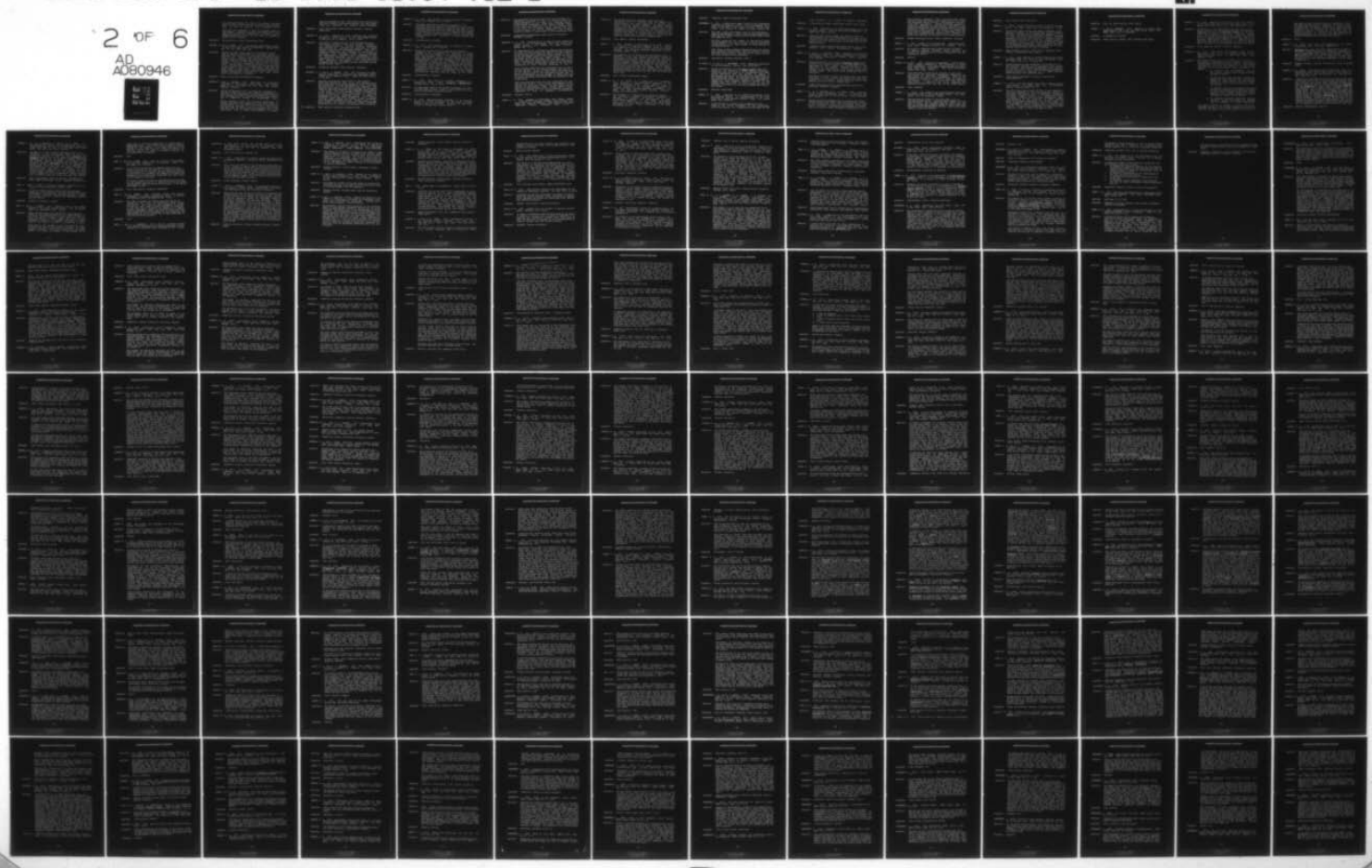
Abstract: An investigation of a 14-mile segment of the Mississippi River, between the Missouri and Ohio Rivers, determined the effect of channel stabilization works, i.e., dikes and bankline revetments, upon the river, as constructed by the U.S. Army, Corps of Engineers, in an effort to provide a 9-foot-deep navigation channel.

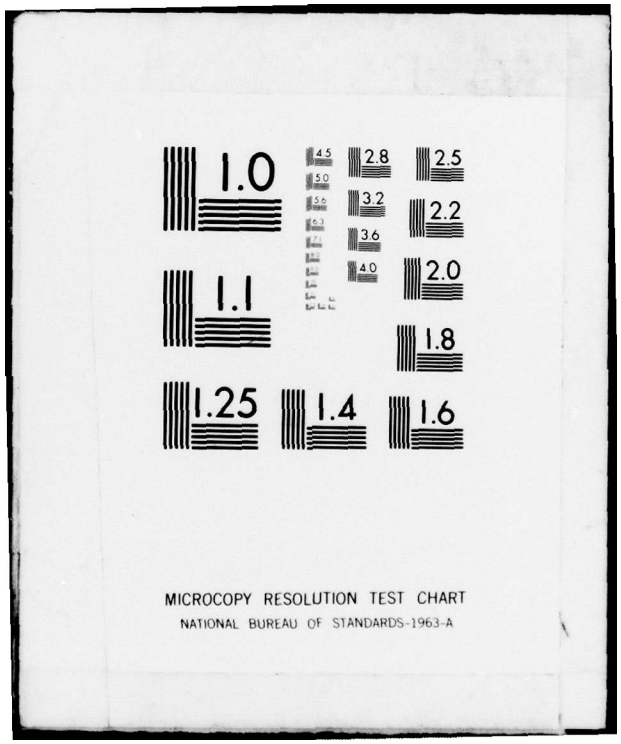
Rapid changes in the channel configuration resulted between 1889 and 1907, when the first river training structures were built, since these early dikes were very effective in forming deposits between them in a short time. The resultant bed scour deepened the navigation channel and lowered river stages for low-water design flows. In contrast, later such work resulted in reduced rates of change due to less extensive stabilization work.

A computer program was developed which computed and plotted channel factors from hydrographic survey data. Contracting the 14-mile segment of river from 1,800

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to 1,200 feet during the 1966 to 1971 period increased both navigation depths and the low-water cross sectional area, as well as reducing the width/depth ratio.

The river bed displayed a rise for surveys taken at high stages. Dredging has been eliminated within this reach and preliminary investigation indicates that a lesser contraction width can be used in subsequent stabilization programs.

Keywords: Channelization, Middle Mississippi River

DEGURSE, P. and V. BUTLER. 1975. Chlorinated hydrocarbon residues in fish from major waters of Wisconsin. Manage Rept. No. 79. Wis. Dept. Nat. Res.

Abstract: During the past several years, the Wisconsin Department of Natural Resources has conducted surveys to determine the levels of chlorinated hydrocarbon residues in fish. Samples were collected from selected inland lakes and streams and from areas of the boundary waters. During 1973 and 1974, these surveys were continued by the Fish Management Section at a limited level. The purpose of this effort was to provide data on the residue levels of contaminants of fish from the major waters of the state. The waters selected were those known or suspected to have relatively high chlorinated hydrocarbon contamination and very active sport and commerical fisheries.

Keywords: Fish, Chlorinated hydrocarbons, Wisconsin

DEGURSE, P. and J. RUHLAND. 1972. Occurrence of chlorinated biphenyls in Mississippi River Fish. Fish Manage. Rept. No. 52 Wis. Dept. Nat. Res. Bur. Fish. Manage. Madison, Wisconsin.

Abstract: During the spring of 1970, a survey was initiated relative to pesticide and other organic contaminants in the fish of the Mississippi River bordering Wisconsin. This waterway provides a highly productive sport fishery and a commerical fishery of considerable value.

During previous years the Wisconsin Department of Natural Resources had completed an extensive survey of inland waters with the major objective of determining the pesticide residues in fish. During this survey note was made of chlorinated hydrocarbons other than pesticides. Some of these were observed to obscure

results obtained for DDT. These additional contaminants were not related to pesticide residue, but were associated with industrial and domestic waste discharge.

Keywords: Fish, Chlorinated hydrocarbons, Wisconsin, Fishing, Pesticides

DELFINO, J. J. 1977. Effects of river discharge and suspended sediment on water quality in the Mississippi River. J. Environ. Sci. & Health. 12(3): 79-95.

Abstract: Variations in water quality in the Mississippi River from August 1972-July 1974 were studied. Changes in the concentrations of selected chemical parameters were examined as a function of variations in hydrological conditions and suspended sediment. The river's chemical composition was affected by variations in discharge. High discharge diluted ionic substances but substantially increased total suspended solids. The increased suspended solids concentrations were responsible for the high levels of COD, total phosphorus, iron, manganese, and copper. COD correlated with increased flow and suspended solids, while BOD and TOC showed neither trend.

Keywords: Discharge, Sediment, Water quality, Chemistry

DELFINO, J. J. and D. J. BYRNES. 1975. The influence of hydrological conditions on dissolved and suspended constituents in the Missouri River. Water Air Soil Pollut. 5: 157-168.

Abstract: Physical and chemical consituents of the Missouri River near Brownville, Neb. U.S.A. were studied during the period May, 1970 through December, 1972. Considerable variation in river discharge was observed. The changing hydrological conditions affected the concentrations of both the dissolved and suspended constituents in the river. Rain and snowmelt runoff increased the river discharge and also contributed to increased turbidity and total suspended solids. A number of parameters including total phosphorus, total organic nitrogen, oxygen demand and certain metals correlated with increased suspended solids. However, most of the major anions and cations measured showed decreased concentrations as a result of increased river discharge.

Keywords: Water quality, Turbidity, Missouri River

DENNING, D. G. 1937. The biology of some Minnesota Trichoptera. Trans. Am. Entomol. Soc. 63:17-43.

Abstract: The great abundance of material available in the Minnesota area, the dearth of information in the literature regarding the immature stages and the need for information regarding both the immature and adult stages of Trichoptera led the writer to undertake the present study. A list of species currently used in the taxonomy rearing methods and a discussion of eight species was included.

Keywords: Invertebrates, Minnesota

DENNING, D. G. 1943. The Hydropsychidae of Minnesota (Trichoptera). Entomol. Am. 23:101-171.

Abstract: During the course of the biological and taxonomic studies of the Trichoptera of Minnesota it became apparent that the females of the order used be placed on a firm taxonomic basis. No information is of more basic importance to biologists than characters for the identification of species. However, such information is completely lacking for the females of this order. In the past the determination of females was possible only through their direct association with the male. To simplify additional biological work it will be necessary that the females be associated with the described males and that illustrations of the female genitalia and workable keys be drawn up for them.

Keywords: Invertebrates, Minnesota

DENNIS, C. J. 1974. More about the buffalo treehopper on a Mississippi River island (Homoptera membracidae). Entomol. News. 85(1): 29-30.

Abstract: A single adult male of the buffalo treehopper was seen on cottonwood on Howie Island at about mile 623 on the Corps of Engineers navigation chart.

Keywords: Invertebrates, Treehoppers

DENNIS, D. S. 1975. Polychlorinated biphenyls in the surface waters and bottom sediments of the major drainage basins of the United States. Presented at EPA Conf. on PCB's, Chicago, Nov. 19-21, 183 p.

Abstract: Data gathered from monitoring activities indicate the widespread occurrence of PCB's in surface waters and bottom sediments of the major U.S. drainage basins. A preliminary assessment shows median residue levels of the positive detections for 1971-74 ranging from 0.1-3.0 mg/l for unfiltered water samples and from 1.2-160.0 mg/kg for bottom sediments. The highest levels are found in basins east of the Mississippi River.

Keywords: Chlorinated hydrocarbons, Water quality, Pollution, Sediment, Toxicant

DENNISON, S. G. 1968. Determination of fecal-coliform densities in Pool 6 of the Mississippi River for spring and summer seasons. B.A. Thesis, St. Marys College, Winona, MN. 71 p.

Abstract: The membrane-filter technique for determining densities of fecal coliform bacteria was applied to water samples collected from forty sampling points located in Pool 6 of the Mississippi River; four times during the spring and seven times during the summer season. It would seem from the data presented that the majority of the fecal coliforms are restricted to the south (Minnesota) shore. The Winona sewage plant seems to be the major contributor of fecal coliform organisms in Pool 6.

Fecal coliform densities were determined for the influent and effluent of the Winona sewage plant during a 24 hour period. Except for those fecal coliforms that may be concentrated in the settleable solids, part of which are extracted from the sewage, it would seem that no fecals are being eliminated from the effluent of the sewage plant.

Fecal coliform densities were also determined for various points along a local creek (Rollingstone Creek) and for its adjoining creeks. The data show that the portion of Rollingstone Creek, called Speltz Creek, that runs throught the town of Rollingstone, Minnesota, represents an area of dangerous contamination.

Keywords: Bacteria, Pool 6

DESAI, C. S. 1970. Seepage in Mississippi River Banks. Report 1. Analysis of transient seepage using viscous flow model and numerical methods. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 71 p.

Abstract: The design of stable riverbank slopes along the Mississippi River is dependent upon the seepage conditions within the banks generated by varying river level, including sudden drawdown. Available seepage analyses are not adequate for the determination of the continuously changing free-water surface under time-dependent variations in river levels. A parallel plate viscous flow model was constructed and tested and was found to constitute a reliable means of obtaining the transient free surface within a sloping bank.

Keywords: Flow, Models, Channel maintenance

DESAI, C. S. 1973. Seepage in Mississippi River banks. Report 1. Analysis of transient seepage using a viscous-flow model and the finite difference and finite element methods. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 108 p.

Abstract: The stability of the banks of the Mississippi River is dependent in part upon seepage conditions induced by variations in the river level. Specifically, the drawdown conditions become significant for the design of stable riverbank slopes and protective structures. A parallel-plate, viscous-flow model and the theory governing fluid flow through the model. Various experiments were performed using the model, and a special finite difference scheme was developed for solving approximate equations governing one- and two-dimensional fluid flow.

Keywords: Flow, Channel maintenance, Models

DEXTER, R. N., S. P. PAVLOU, W. G. HINES and D. A. ANDERSON. 1978. Dynamics of Polychlorinated Biphenyls in the Upper Mississippi River. Final Report. Phase I, Task 1: Compilation of Information. Prepared for Columbia National Fishery Research Laboratory, U.S. Dept. Int. Fish and Wildlife Service. Contract Number 14-16-009-78-026.

Abstract: This document is a compilation of pertinent current and historical research information necessary to describe the transport and distribution of polychlorinated biphenyls in the Upper Mississippi River. This report helps to predict the distribution and impact of toxic organic substances in the Upper Mississippi River.

Keywords: Chemistry, Upper Mississippi River

DIETERMAN, S. 1975. A short-term impact study of the zooplankton populations dynamics in Pool 3 of the Mississippi River near the Northern States Power Red Wing Nuclear Power Plant. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: This was a short-term impact study of the zooplankton populations dynamics in Pool 3 of the Mississippi River near the NSP Prairie Island Nuclear Power Plant during the summer of 1973.

The data measuring the change in Rotifer/Crustacean ratios supports the fact that the river at this point is definitely in the later stages of self-recovery or self-purification.

Also there is some evidence indicating that the turbulence caused by Lock and Dam 2 and Lock and Dam 3 near the NSP Plant have helped in the rate of the river's recovery from the Twin Cities effluents.

Keywords: Zooplankton, Thermal effluent, Pool 3

DI LUZIO, N. R. and T. J. FRIEDMANN. 1973. Bacterial endotoxins in the environment. Nature. 244 (5410):49-51.

Abstract: During an evaluation of the Limulus lysate assay procedure for the detection of Gram negative endotoxins, deionized water was found to be contaminated with endotoxins. Endotoxins were also present in samples of New Orleans tap water, which comes from deep levels of the Mississippi River. To appreciate the environmental distribution of endotoxins, studies were undertaken to compare the Gram negative endotoxin content of New Orleans water with that of other cities, as well as endotoxin distribution in various beverages and biological fluids.

Keywords: Bacteria, Physiology

DORRIS, T. C. 1956. Limnology of the Middle Mississippi River and adjacent waters. II. Observations on the life histories of some aquatic Diptera. Trans. Ill. State Acad. Sci. 49:27-33.

Abstract: In the course of a study of the limnology of five lakes on the levied floodplain of the Mississippi River near Quincy, IL., observations were made on the

life histories of a number of aquatic dipterans.

Keywords: Invertebrates, Middle Mississippi River, Life history

DORRIS, T. C. 1958. Limnology of the Middle Mississippi River and adjacent waters. Lakes on the levied floodplain. Am. Midl. Nat. 59(1): 82-110.

Abstract: Survey of four lakes (Goose, Big, Sand, and Mud) on the floodplain of the Mississippi River near Quincy, Illinois to study seasonal and annual variations in the plankton and the bottom fauna in relation to environmental factors.

Keywords: Limnology, Middle Mississippi River, River lake, River lowland, Dike, Survey, Invertebrates, Plankton

DORRIS, T. C. and B. J. COPELAND. 1962. Limnology of the Middle Mississippi River. III. Mayfly populations in relation to navigation Water-level Control. Limnol. Oceanogr. 7(2): 240-247.

Abstract: Naiad populations of the mayfly Hexagenia rigida were studied in an isolated channel of the Mississippi River. Egg-laying by adult females was concentrated at the upper end of the channel. Numbers of naiads were greatest at the upstream end of the channel during most of each summer. The naiads moved downstream prior to emergence.

Following a winter in which the water level was drawn down about 4 ft for 6 weeks, the numbers of naiads were reduced at all stations. Populations near shore were reduced more than those in deeper water.

Keywords: Middle Mississippi River, Invertebrates, Navigation, Limnology, Mayflies, Drawdown

DORRIS, T. C., B. J. COPELAND and G. J. LAUER. 1963. Limnology of the Middle Mississippi River. IV. Physical and chemical limnology of river and chute. Limnol. Oceanog. 8(1): 79-88.

Abstract: During the period November 1954 to January 1956 weekly determinations were made of various limnological factors in the Mississippi River and Cottonwood Chute near Quincy, Illinois. Information was obtained on temperature, ice cover, stream discharge, precipitation, cur-

rent velocity, turbidity, color, alkalinity, pH, carbon dioxide, dissolved oxygen, total dissolved solids, total and suspended organic solids, photosynthetic productivity, and respiration. Stream discharge exerted an overriding influence on most factors. Periods of high stream discharge were generally accompanied by increased turbidity, carbon dioxide, and solids, by lowered and more uniform temperatures, and by decreased dissolved oxygen and photosynthetic productivity. Opposite effects were observed at periods of low stream discharge.

Keywords: Middle Mississippi River, Chute, Chemistry, Limnology

DORSEY, F. L. 1941. Master of the Mississippi. Riverside Press, Camb., Mass. Houghton Mifflin, Co., Boston. 295 p.

Abstract: This book is compiled from letters written by Henry M. Shreve, personal journals, family letters, and records and descriptions by early adventures into the Mississippi Valley.

Keywords: History

DOUGAL, M. D. (Ed.). 1969. Flood plain management: Iowa's experience. Papers presented at the conference on Flood plain management. Sixth Water Resources Design Conference, Iowa State University. Iowa State University Press, Ames, Iowa. 270 p.

Abstract: This seven-part volume brings together in one integrated text the available information concerning the many phases of flood plain management. Each of the chapters is devoted to a specific phase or aspect of the subject. In all, they cover the many problems which arise in enacting local action programs for achieving optimum and wise use of the flood plains.

Keywords: Iowa, Flooding

DUNHAM, L. L. 1970a. Fish sampling by electro-fishing below ten navigation dams on the Mississippi River. Ill. Dept. Cons., Div. of Fisheries. 10 pp.

Abstract: Electro-fishing survey in 1970 from Dams 12-21 on the Mississippi River. Recorded were number of fish (per 60 min). The tailwater habitat below Lock and Dam 13 provided the greatest number of fish, while Lock and Dam 16 provided greatest variety. Dam 15 had least number of fish and variety.

Keywords: Fish, Survey, Dam, Pools 12-21

DUNHAM, L. L. 1970b. Aerial Recreation Survey of the Mississippi River. Ill. Dept. Cons., Div. of Fisheries. 14 pp.

Abstract: *During 1970 aerial counts were made on weekends, week*days and holidays on the Mississippi River bordering Illinois. Heaviest boat fishing was observed in Pool 13. Pool 15 had the heaviest bank fishing. Heaviest pleasure craft usage was in Pool 26. Heaviest commercial barge traffic was in Pool 26. Highest number of tents was in Pool 13. Pool 26 had the greatest number of swimmers and waterskiers. Boat fishermen was highest on weekends and pleasure crafts highest on holidays. Lightest recreational use was on weekdays.

Keywords: Sport fishing, Illinois, Pools 12-26, Commercial boat traffic, Recreational boat traffic

DUNHAM, L. L. 1971. Fish sampling by electro-fishing gear below navigation dams no. 12-26 on the Mississippi River. Ill. Dept. Cons., Div. of Fisheries.

Abstract: Electro-fishing survey conducted in 1970 and 1971 in the tailwater habitats of the navigation dams bordering Illinois. The following parameters were recorded: No. of fish (per 60 min), various physical parameters, seasonal variation, condition (C) of common species, depth profiles, and fisherman usage.

Keywords: Fish, Survey, Tailwater, Illinois, Pools 12-26, Electroshocking

DUNHAM, L. L. 1973. 1972 Mississippi River Pool 13 Sport Fishing Creel Census. Ill. Dept. Cons., Div. of Fisheries. Special Fisheries Report No. 38.

Abstract: The 1972 creel census survey of Pool 13 was conducted under the auspices of the Fish Technical Section of the Upper Mississippi River Conservation Committee. This sport fishery survey is a coordinated effort initiated in 1962 by the five state conservation agencies belonging to the U.M.R.C.C. to creel selected pools of the Upper Mississippi River every 5 years. In 1972, Minnesota creeled Pools 4 and 5, Wisconsin Pool 7, Iowa Pools 11 and 18, Illinois Pool 13, and Missouri Pool 26. Illinois has creeled Pool 13 every five years starting in 1962, in 1967, and again in 1972.

Keywords: Pool 13, Sport fishing, Creel census

DUNHAM, L. L. and B. BERTRAND. 1972. Sampling of Savanna Army Depot Waters, May 17-19 and July 12-14, 1972. Ill. Dept. Cons., Div. of Fisheries.

Abstract: A composite of tables.

Keywords: Water quality, Survey, Fish, Savannah Army Depot

EBERLEY, L. W. 1975. Spawning activities of major fish species in the Monticello area of the Mississippi River. M.S. Thesis, St. Cloud State Univ., St. Cloud, MN. 80 p.

Abstract: Collections in the Mississippi River near the nuclear plant consisted of 1497 Cyprinus carpio, 765 shorthead redhorses, 531 white suckers during 6 April to 14 August 1974. Carp spawned erratically. Redhorses spawned early and mid-May when water temperatures ranged from 9 to 11 C, white suckers spawned in late April and early May when temperatures reached 10 C. Spawning during April and May was during periods of rising discharge and no indication of pre-seasonal spawning was found.

Keywords: Fish, Spawning, Thermal effluent, Minnesota

ECKBLAD, J. W. 1973. Final report: environmental impact assessment study, Pool 9, of the northern section of the Upper Mississippi River. N. Star Res. Inst., Minneapolis, Minn.

Abstract: The overall objectives of this report are to identify and provide an assessment of the impacts of the Corps of Engineers activities related to Pool 9. Specifically, following this section, the report is in the format required for the Environmental Impact Statement, and seeks:

1. To identify the environmental, social, and econimic impacts of the Corps activities related to Pool 9.

2. To identify and, where possible, measure the beneficial contributions and detrimental aspects of these impacts and draw overall conclusions about the net effects of Corps' activities.

3. To recommend actions and possible alternative methods of operations that should be taken by the Corps of Engineers and other public agencies and private groups to reduce detrimental aspects of the project.

4. To identify additional specific research needed to assess the impacts and increase the net benefits of Corps operations.

The report includes an analysis of natural and socio-economic systems. The natural systems include terrestrial and aquatic plant and animal life as well as

the nature of the land and quality of the water. Socio-economic systems include industrial activities, such as income and employment generated by barge traffic or activities in operating the locks and dams and commercial fishing: recreational activities, such as fishing, boating, or hunting that are affected by Corps operations: and cultural considerations, which include archaeological and historical sites.

Keywords: Pool 9

ECKBLAD, J. W. 1975a. The Asian clam Corbicula in the Upper Mississippi River. Nautilus. 89(1). 4 p.

Abstract: Corbicula spp. were found just downstream of an effluent from a generating plant in Lansing, Allamakee Co. in the Mississippi River along the Iowa side. This is approximately 660 river miles above Cairo, Illinois. The distribution of clams is sporadic, rather than continuous, but some specimens appeared to be at least 2 years old.

Keywords: Mussels, Benthos, Ecology, Distribution, Iowa, Discharge, Clams

ECKBLAD, J. W. 1975b. The benthos and sedimentation rates of a Mississippi River flood plain lake. Pap. Pres. at 23rd Ann. Mtg. N. Am. Benthological Soc., Springfield, Ill., March 20, 1975.

Abstract: Studies were conducted during 1973 and 1974 on Big Lake, a 632-acre lake in Pool 9 of the Upper Mississippi River. This shallow (2.9 ft mean depth) backwater habitat supports a macroinvertebrate fauna dominated by Sphaerium sp. and Hexagenia sp. Total macroinvertebrate population densities for summer months averaged 3268 per square meter, and dry weights averaged 48.6 grams per square meter. Mean diversity of numbers exceeded mean diversity of dry weights. Macroinvertebrate communities within stands of emergent Sagittaria sp. had somewhat higher diversity but reduced total population densities and dry weights. Concern over the future status of the habitat is warranted since sedimentation rate dating (using Cesium-137) suggests rates which vary from 0.5 to 1.5 inches per year for various portions of the lake.

Keywords: Benthos, Sedimentation, Pool 9

ECKBLAD, J. W., N. L. PETERSON, K. OSTLIE, and A. TEMTE. 1977. The morphometry, benthos and sedimentation rate of a flood plain lake in Pool 9 of the Upper Mississippi River. Am. Midl. Nat. 97(2): 433-443.

Abstract: Big Lake is a shallow 256-ha backwater lake on the floodplain of the Mississippi River in NE Iowa. During the summers of 1973 and 1974 Sphaerium and Hexagenia made up 81% of the benthic macroinvertebrate abundance and 92% of the benthic biomass; both taxa had greatly reduced abundance and biomass within stands of emergent Sagittaria along the lake margin. Between 1896 and 1973 about 76 cm of sediment had accumulated in Big Lake, and the recent sedimentation rate (1964-1974) was about 1.7 cm/year. The calculated annual reduction in lake volume of about 37,400 m^3/year suggests that the physical and biological components of this productive aquatic habitat will be greatly modified during the next few decades.

Keywords: Pool 9, Macrophyte, Benthos, Mussels, Sedimentation, Iowa, Upper Mississippi River, Biomass, Productivity

EDDY, S. 1934. A study of freshwater plankton communities. University of Illinois Bulletin 31(45): 6-90.

Abstract: A study of 2000 plankton collections from streams, ponds and rivers discusses the various habitats, types of plankton (including the dominant species) indigenous to each, physical, chemical and ecological factors and periodicity.

Keywords: Plankton, Chemistry, Ecology

EDDY, S. and A. C. HODSON. 1961. Taxonomic keys to the common animals of the north central states. 3rd. Ed. Burges Publ. Co., Minneapolis, MN. 162 pp.

Abstract: These taxonomic keys are prepared for the purpose of aiding in the identification of the common animals of the north central states or region north of the Ohio River, exclusive of those groups for which current taxonomic literature is already available or which would be too large to include in a brief set of keys.

These keys do not attempt to cover the detailed classification for most of the groups considered. For many groups of animals, these keys include only the common genera. The number of species in some groups is so

large that it would be impossible to include them in abbreviated form. Other groups have not been thoroughly studied for this region. It is the intention of the authors to keep these keys as simple as possible so that they may be of service to students starting the intricate study of taxonomy.

Keywords: Keys

EDDY, S. and P. H. SIMER. 1929. Notes on the food of the paddlefish and the plankton of its habitat. Trans. Ill. St. Acad. Sci., 21:59-67.

Abstract: If we wish to understand the feeding habits of this fish in relation to the quantity of available plankton in the waters of its habitat, we must make quantitative collections of the plankton and compare the number and abundance of the constituent organisms with those found in the stomach of the fish.

The present paper is based on data obtained from a study of the stomach contents of 30 paddlefish which were taken from McIntyre Lake near Money, Mississippi, in the spring and summer of 1927.

Keywords: Fish, Food habits, Plankton, Paddlefish

EDDY, S. and T. SURBER. 1943. Northern fishes with special reference to the Upper Mississippi Valley. University of Minnesota Press, Minneapolis, MN. 276 p.

Abstract: For years fishermen and others have been asking the authors for all sorts of information about fishes and fishing. This book has been prepared to answer, in part at least, some of these hundreds of questions. At the same time it presents the results of a comprehensive, systematic study, the need for which has long been recognized by those engaged in the propagation and maintenance of native fishes and by many sportsmen as well as scientific workers.

Keywords: Fish

EDDY, S. and J. C. UNDERHILL. 1974. 3rd Ed. Northern Fishes (with special reference to the Upper Mississippi Valley) University of Minnesota Press, Minneapolis, MN. 414 pp.

Abstracts: A book which reports the changes which have been discovered in the distribution of Minnesota fishes and additions to the list of species known from Minnesota waters.

Keywords: Fish, Distribution, Species list

EDSON, D. T. 1973. Investigation of ERTS-A Images for Application of Thematic Mapping. Geological Survey, Washington, D.C. 3 p.

Abstract: The author has identified the following significant results. Composite mosaics made of open water extractions of the Mississippi River at normal stage and those derived from various flood stages illustrate with startling clarity the magnitude of the recent flood and provide an excellent and timely historical documentation of the temporal changes in flood extent between successive cloud-free ERTS-1 passes.

Keywords: Flood, Backwater, Remote sensing

EILER, H. O. and H. F. BERNHARD. 1973. The biological effects of two condenser cooling modes. Proceedings of the American Nuclear Society, San Francisco, California.

Abstract: These studies were designed to define the preoperational characteristics of the aquatic environs in the vicinity of the Station and to assess any environmental effects of Station operation during two different modes of open-cycle condenser cooling-water discharge. Commercial power production at the Station began in April 1972, and until August 1972 the condenser cooling water was discharged to the river via a shoreline side-jet discharge structure. The Station discontinued this mode of discharge in August 1972 and initiated operation of the twin diffuser-pipe discharge system. The results of comprehensive limnological and biological studies during the past year at the Quad-Cities Station indicate that no adverse environmental effects or violations of state or federal water-quality regulations resulted from once-through condenser cooling using the twin diffuser-pipe system.

Keywords: Habitat alteration, Ecology, Thermal effluent, Nuclear power

EILER, H. O. and J. J. DELFINO. 1974. Limnological and Biological studies of the effects of two modes of open-cycle nuclear power station discharge on the Mississippi River (1969-1973). Water Research, 8(11):995-1006.

Abstract: The impact on the aquatic environs of two modes of open-cycle condenser cooling at Quad-Cities nuclear power station, situated on the Illinois side of the Mississippi River is assessed. By careful monitoring of effluents, the ecological impact of station operation can be evaluated, and modification of discharge systems can be implemented to assure minimal or no disturbance to aquatic ecosystems.

Keywords: Thermal effluent, Nuclear power, Limnology, Ecology, Illinois

EILER, H. O. and J. J. DELFINO. 1975a. Effects of two modes of cooling water discharge on river biota. Proceedings of the International Atomic Energy Agency. Oslo, Norway.

Abstract: Environmental studies during two modes of once-through condenser cooling at the Quad-Cities Nuclear Power Plant on the Mississippi River are reported.

Keywords: Thermal effluent, Nuclear power, Habitat alteration, Ecology

EILER, H. O. and J. J. DELFINO. 1975b. Comparative effects of two modes of cooling-water discharge on Mississippi River biota and environmental ecosystems. International Atomic Energy Agency. Vienna, Austria.

Abstract: Environmental studies during operation of two different modes of once-through condenser cooling at the Quad-Cities Nuclear Power Plant on the Mississippi River are reported. During operation of an interim shoreline discharge numerous localized changes in biotic communities downstream from the point of discharge compared with pre-operational data were detected. Water temperatures greater than 7° C (44.6° F) above ambient and chlorine concentrations of 0.22 ppm were believed to be responsible for adversely affecting downstream biological communities, such as periphyton inhibition and fish displacement.

Keywords: Thermal effluent, Nuclear power, Habitat alteration, Limnology

EILER, H. O., O. DEVIK, A. VON NIDA, P. BALLIGAND, Z. HATLE, G. S. AGEEV, and J. J. DELFINO. 1974. Alternative methods for the management of heated effluents, and possible beneficial uses of waste heat. Presented at IAEA Conf. on Env. Effects of Cooling Systems at Nuclear Power Plants, Oslo, Aug. 26-30, 1974. p. 685.

Abstract: Methods for management, reduction of negative environmental impacts, and beneficial uses of aquatic thermal discharges are discussed. Topics include: two cooling alternatives for the Mississippi River Quad-Cities Nuclear Plant and their ecological impacts; utilization of power plant waste heat and minerals for aquaculture; the feasibility of a Brayton Cycle Combined Thermal-Electrical Utility System; use of thermal discharge heat for agriculture, fisheries, and space heating.

Keywords: Thermal effluent, Nuclear power, Habitat alteration, Fish, Production, Research

ELA, J. 1974. Corps games in Mid-America. Sierra Club B, 59(9): 11-15.

Abstract: USACE and its allies would like to quadruple the navigational capacity of the upper Mississippi waterway over the next 50 years, thus, increasing the system's rated capacity from 46 to 190 million ton/yr. But USACE would prefer not to tell the public about his plan, or about the specious assumptions it uses to justify the project. While the commercial waterway operates to the immense gain of millions of people in mid-America. The navigational facilities have already seriously compromised the natural integrity and recreation potential of the river system.

Keywords: Upper Mississippi River, Dam, Commercial boat traffic, Canalization

ELKINS, W. A. and R. W. SHARP. 1962. Recreational fishing in the national wildlife refuges. U.S. Dept. Int., Fish and Wildl. Serv., Bur. Sport Fish and Wildl., Cir. 152.

Abstract: The 279 national wildlife refuges provided approximately 3 1/2 million fisherman days of angling in 1960.

Distributed over the four flyways, and extending from Alaska to the Florida Keys, the refuges provide a wide variety of fishing.

Keyword: Sport fishing, Refuges

ELLIS, J. M. 1978. Fish communities in three successional stages of side channels of the Upper Mississippi River. M. S. Thesis, Univ. of Missouri. 66 p.

Abstract: This study is a two-year pre-opening phase of a four-year project to determine the effects of opening side channels on the limnology and the abundance, distribution, and composition of fish communities in side channels of the Upper Mississippi River. Three selective side channels representing different stages of riverine succession were surveyed to determine seasonal variation of primary physical and chemical features, of relative abundance, composition and distribution of fishes and to determine the dominant fish.

Keywords: Fish, Ecology, Side channel, Upper Mississippi River

ELLIS, M. M. 1931. Some factors affecting the replacement of the commercial fresh-water mussels. U.S. Bur. Fish. Circular.

Abstract: Discussed the natural replacement of mussels, breeding stock and gravid females, river conditions of erosion silt, municipal and industrial wastes and river improvement affecting mussels.

Keywords: Mussels, Life history, Habitat alteration

ELLIS, M. M. 1936. Erosion silt as a factor in aquatic environments. Ecology, 17(1): 29-42.

Abstract: In order to ascertain quantitatively some of the specific effects of erosion silt on aquatic complexes, biophysical and biochemical studies have been made at over 700 stations on streams of the Mississippi-Ohio-Missouri System, and other interior waters.

Keywords: Sediment, Habitat alteration

ELLIS, M. M. 1943. A study of the Mississippi River from Chain of Rocks, St. Louis, Missouri, to Cairo, Illinois, with special reference to the proposed introduction of ground garbage into the river by the City of St. Louis. U.S. Fish and Wildl. Serv., Spec. Sci. Rept. 8. 22 p.

Abstract: Field studies of the Mississippi River between Chain of Rocks, St. Louis and Cairo, Illinois made during September 1931 and September 1934 show that during the period of low water and low dissolved oxygen the Mississippi River loses a considerable portion of its oxygen load in the immediate vicinity of St. Louis. The zones of low oxygen between Chain of Rocks and Cape Girardeau are correlated with the wastes from the St. Louis area. D.O. did not recover even below mixing area of Ohio River.

Keywords: Pollution, Missouri, Illinois

ELLIS, M. M., A. D. MERRICK and M. D. ELLIS. 1931. The blood of North American fresh-water mussels under normal and adverse conditions. Bull. U.S. Bur. Fish. 46(1097): 509-542.

Abstract: Discussion of the normal blood of fresh-water mussels; method of taking samples, general physical properties, specific gravity, total solids and ash, blood sugar, inorganic salts, hydrogen-ion concentration and buffer values and blood gases; and changes in blood of living mussels induced by environmental factors, effects of changes in salt content of water; and effects of exposures to air.

Keywords: Mussels, Physiology, Research, Chemistry

ELSTAD, C. A. 1977. Macrobenthic survey of navigation Pool 8 of the Upper Mississippi River with special reference to ecological conditions. M. S. Thesis, Univ. of Wisconsin, LaCrosse, WI.

Abstract: An inventory of the macrobenthic fauna of Pool 8 was made. The survey was attempted to correlate with chemical and physical conditions also recorded. Forty-one areas were sampled. A trend towards decreasing eutrophy was found from area one to forty-one. Habitat preferences of benthic communities varied dependent on eutrophication present.

Keywords: Benthos, Pool 8, Survey, Habitat alteration

EMGE, W. P. 1972. Study plan for an environmental inventory and assessment of the Mississippi River 9-ft. channel project between St. Louis, Missouri, and Cairo, Illinois. USACE Waterways Experiment Station, Vicksburg, Miss. 36 p.

Abstract: The purpose of the Mississippi River 9-ft. channel project is to obtain and maintain a 9 x 300 ft. navigation channel from the confluence of the Missouri River to the confluence of the Ohio River. An extensive terrestrial and aquatic inventory is required to establish a data base sufficient for biological analysis, and to assess physical changes resulting from contraction efforts to obtain and maintain a 9 ft. channel. A geomorphic model is required to determine the river's hydraulic response to construction and extension of dikes. Outlined are procedures and techniques for an overall environmental inventory of the Mississippi River floodplain between St. Louis and Cairo, Illinois, and the framework is provided for assessing data and analyzing relationships of the physical, biological, chemical, and cultural elements of the project area.

Keywords: Missouri River, Ohio River, Channelization, Dredging, Ecology, Dike, Survey

EMGE, W. P., R. C. SOLOMON, J. H. JOHNSON, C. R. BINGHAM, and B. K. COLBERT. 1974a. Physical, biological, and chemical inventory of twenty-three side channels and four river border areas, Middle Mississippi River. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 166 p.

Abstract: This report is to be used for the preparation of an Environmental Impact Statement (EIS) by the U.S. Army Engineer District, St. Louis. Twenty-three side channels were sampled in June and August 1972 and 13 of the 23 side channels and 4 river border areas were sampled in July 1973. Physicochemical parameters sampled were dissolved oxygen, temperature, turbidity, pH, and alkalinity. Biological elements sampled were plankton, benthos, and fish. Meteorological parameters included wind velocity, cloud cover, and ambient air temperature. Other physical parameters measured were bottom sediments and discharges. Methods and materials used to gather data are described.

Keywords: Channelization, Middle Mississippi River, Side channel, Plankton, Benthos, Fish, Sediment, Discharge, Temperature, Navigation

EMGE, W. P., R. C. SOLOMON, J. H. JOHNSON, C. R. BINGHAM, and B. K. COLBERT. 1974b. Physical, Biological, and Chemical Inventory of Twenty-Three Side Channels and Four River Border Areas, Middle Mississippi River. Army Engineer Waterways Experiment Station Vicksburg, MS. 595 p.

Abstract: The report presents appendices of the middle Mississippi River nine-foot channel project. Included are analyses of water geometry, sediments, and water supply. Data are also included on physical, chemical, and biological properties.

Keywords: Middle Mississippi River, Channelization, Chemistry, Sediment, Flow, Water quality

EMGE W. P., R. C. SOLOMON, J. H. JOHNSON, C. R. BINGHAM, and B. K. COLBERT. 1974c. Physical, Biological, and Chemical Inventory of Twenty-three Side Channels and four River Border Areas, Middle Mississippi River. Army Engineer Waterways Experiment Station. Vicksburg, Miss. 621 p.

Abstract: List of reports on the 9-ft. channel project; Aerial photographs of side channels and river border areas; Schematics of side channels; 1972 Profiles and thalwegs of side channels; High bank and willow line elevations; Duration of water at or above willow line and high band elevations; 1973 Profiles and thalwegs of side channels and river border areas; Velocities and discharges; WES staff gage side channels; Comparison of water-geometry relationships for similar stages.

Keywords: Middle Mississippi River, Channelization, Phytoplankton, Zooplankton, Fish, Benthos, Side channel, Main channel

ERICKSON, J. R. 1962. A comparison of the macrobenthic fauna of four lakes adjacent to the Mississippi River near Winona, Minnesota. M.S. Thesis (in education). Winona State College, Winona, MN. 42 p.

Abstract: A search during June 1961 for lentic populations of mayflies was conducted. Environmental factors which influence emergence of Hexagenia mayflies from the upper Mississippi River were discussed.

Keywords: Invertebrates, River lake, Mayflies

ERICKSON, J. R. 1964. Three Southeastern Minnesota Lakes as Possible Habitat for Hexagenia Mayflies. J. Minn. Acad. Sci., Vol. 32, No. 1.

Abstract: Three small lakes near Winona, Minnesota, were sampled to determine if they supported populations of Hexagenia mayfly nymphs. Hexagenia nymphs were rare in Lake Winona and the Gravel Pit, and none was found in Crooked Slough. A low dissolved oxygen content at the mud-water interface is probably the limiting factor in Lake Winona and Crooked Slough. The limiting factor in the Gravel Pit is probably the bottom type.

Keywords: Invertebrates, Distribution, Mayflies

ERNEST, P. R. 1967. Analysis of the population of Stephanodiscus nigarae in Pool 6 of the Mississippi River by membrane filtration. B. A. Thesis, St. Mary's College, Winona, MN. 27 p.

Abstract: Membrane filtration techniques were used to determine if there was any variation in the population of Stephanodiscus niagarae in Pool 6 of the Mississippi River. Dams 5A and 6 were used as sampling points. No significant variation was found between these two points. S. niagarae does not seem to be affected by the three to four million gallons of sewage deposited in the Winona pool daily.

Keywords: Phytoplankton, Pool 6, Habitat alteration

ESCHMEYER, R. W. 1944. Harvesting the fish crop. Trans. 9th N. Am. Wildl. Conf. 1944: 202-211.

Abstract: The discussion on harvesting our fish crop is limited mostly to sport fishing in public waters and to game and pan fish. Emphasis is on warm-water fish and on moderately-fished waters. It is assumed that (1) our crop must be so used or harvested as to provide "the greatest good, to the greatest number, for the greatest length of time"; (2) equitable distribution is of primary importance because our fish resources are common property; (3) sustained yield is a desirable objective, and (4) the hook and line is the accepted machinery for harvesting the crop.

Keywords: Harvest, Fish

ESCHMEYER, R. H. and V. T. HARRIS. 1974. Bibliography of research publications of the U.S. Bureau of Sport Fisheries and Wildlife, 1928-72. U.S. Fish Wildl. Serv. Res. Publ. 120. 154 pp.

Abstract: This is a compilation of citations of research.

Keywords: Limnology, Research, Bibliography

ESTERBERG, N. W. 1970. A limnological baseline survey of little Rock Lake, Benton County, Minnesota. M. S. Thesis, St. Cloud State University, St. Cloud, MN. 168 p.

Abstract: Purpose of this study was to establish a limnological baseline on which to base the degree of eutrophication of Little Rock Lake. Chemical, plankton and bottom samples were taken. Also included is a review of the studies done previously on Little Rock Lake.

Keywords: Limnology, Plankton, Benthos, Minnesota, Chemistry

EVANS, BR. C. 1969. A study of incidence of glochidia infection in redhorse, walleye and bluegill in Pool No. 6 Mississippi River. M. S. Thesis, St. Mary's College, Winona, MN.

Abstract: The purpose of this project was to observe frequency of glochidial infection of the following three species of fish: Walleye, Stizostedion vitreum (Mitchill); Bluegill, Lepomis machrocirus (Rafinesque); and Golden Redhorse, Moxostoma erythrurum (Rafinesque). The area studied was Pool Six, located between Dams 5 and 5A of the Upper Mississippi River.

Specimens studied were collected with the aid of a 220-volt AC shocker boat. All specimens were preserved in 10% formalin. Gills were removed and later stained with Turtox CMC*S. All filaments were examined for presence of glochidia. When glochidia were found, the specimen's number was noted as well as approximate number of glochidia observed per infected specimen. Photo-micrographs were made.

This project attempted to show that "mass" infection does not occur in nature and also that specificity of infection of the host is apparent in nature. The rate

of infection seems dependent on body size and feeding habits of the host. Likewise, it is probable that Golden Redhorse is not a host for glochidial infection.

Keywords: Parasites, Disease, Fish, Pool 6, Habitat alteration

EVANS, D. K. 1971. The vegetation of the Mississippi River and mud flats in Jackson County, Illinois. M. S. Thesis, Southern Illinois University.

Abstract: A vegetation study of these flats was undertaken with the following objetives in mind.

1. To prepare an annotated checklist of all vascular plants found growing on the sand and mud flats at selected stations along the Mississippi River in Jackson County, Illinois.
2. To provide a description of the physiography of the sand and mud flat habitat.
3. To analyze the distribution of taxa within the study area.
4. To describe a plant community of the sand and mud flat and some environmental factors associated with it.

Keywords: Vegetation, Habitat, Survey, Illinois, Distribution

EVANS, D. K. 1974. The Flora and Vegetation of a Mississippi River Unprotected Floodplain. ASB (Assoc. Southeast Biol.) Bull. 21(2): 54.

Abstract: See Evans, D. K. 1975.

Keywords: Vegetation, Survey, Ecology, Rare species, Endangered species, Developemnt

EVANS, D. K. 1975. Characteristics of Flora and Succession in the Middle Mississippi River Floodplain. Proc. W. Va. Acad. Sci. 47(1): 7-13.

Abstract: A botanical survey of the unprotected floodplain along the Middle Mississippi River was conducted as part of an environmental impact statement. Nine vegetation-cover types were identified and 302 species of vascular plants were documented in 77,874 acre, 170 mile long area. 13% of the species are considered rare, uncommon or endangered elements in Illinois and Missouri flora. Plant community development proceeds from an annual grassforb type of

high diversity on sand and mud flats to forested stands of lower diversity which occur on infrequently flooded sites.

Keywords: Backwater, Vegetation, Survey, Missouri, Rare species, Endangered species, Illinois, Succession

FAIRWEATHER, V. 1973. The unpredictable Mississippi. Civil Engineering-ASCE. 43(12): 60-62.

Abstract: The Mississippi continues to challenge the considerable expertise of the Corps of Engineers. But great strides have been made in taming this unpredictable river. In the 1927 flood, 600,000 persons were left homeless, in the 1937 flood, 800,000. The floods of 1973 left 40,000 people without homes, a measure of human distress, but also of great progress.

Keywords: Flood

FASSBENDER, R. L. and L. M. NELSON. 1970. The Fox River: A selected bibliography of the Fox River and connected lakes. Wis. Dept. Nat. Res., Bur. Fish. Manage, Rept. No. 44., Madison, WI.

Abstract: This bibliography is intended for use by those aquatic biologists who work primarily on Wisconsin's Fox River system. Geographically, the area covered includes the Fox River, its watershed, and major lakes connected to the stream. Because of vast differences in characteristics references to the Wolf River system, a major tributary to the Fox are not included here.

The bibliography is "selected" in the sense that it is not a complete listing of references pertaining to the Fox River system. For example, the sections on history and geology-geography contain mostly general references that apply to the whole area or large governmental units (i.e., counties). References alluding to individual cities, locals, or people are excluded. The section on biology is most complete and contains references covering many specific phases of aquatic biology excluding references specifically relating to waterfowl and wildlife. The miscellaneous section contains a conglomeration of references that could not easily be categorized under other headings.

Keywords: Fox River, Geology, History, Bibliography

FAWKS, E. 1972. One day eagle count. February 19 or 20, 1972. Iowa Bird Life. 42(2): 48-49.

Abstract: Most of the Mississippi River from its source to below St. Louis, as well as most of the Illinois River was covered in this eagle count. Adults and immatures were differentiated. The most adults were sighted from

Lock and Dam 12 to Lock and Dam 18, and the most immatures were seen along the Illinois River.

Keywords: Eagle, Rare species, Endangered species, Birds

FAWKS, E. 1975. One day eagle count-February 8, 1975. Ill. Audubon Bulletin No. 173, pp 14-15.

Abstract: The original intent of this one day count was to show increases or decreases in the ratio of immatures to adults. Results for the past four years tend to show something else. Each year waters north of our count freeze up. The increased numbers of eagles and the increase of immatures must be caused by eagles coming to the Mississippi River from the south, east or west. If these come from Fish and Wildlife areas where many wounded or crippled waterfowl are found, then the ratio of immatures would be very biased. It is reasonable to assume that the count shows our eagles doing quite well; however the increases must be used with caution.

Keywords: Eagle, Rare species, Endangered species, Birds

FENWICK, G. B. 1969. Water-Temperature effects on the Stage-Discharge Relations in Large Alluvial Rivers. Committee on Channel Stabilization (Army). 46 p.

Abstract: Observations in natural rivers as well as experimental laboratory streams indicate that water temperatures significantly affect stream stage-discharge relations, bed forms, and sediment-transport rates. However, various investigators in this field have reached conclusions that appear to be contradictory, and the complex phenomena involved are not yet fully understood. With a view to clarifying further the water-temperature effects indicated by field measurements, the Committee on Channel Stabilization canvassed the division offices of the Corps of Engineers for measurements in large alluvial rivers.

Keywords: Temperature, Sedimentation, Accretion, Flow, Discharge, Missouri River

FERNHOLZ, W. B. 1964-1971. Annual reports. Mississippi River commercial fishing statistics. Fish Manage. Div., Wis. Cons. Dept. Unpublished.

Abstract: These reports are a series aimed at summarizing results and noting trends in the Mississippi River Commercial Fishery. These statistics are compiled from individual reports obtained from licensed commercial fishermen.

Keywords: Fish, Creel census, Statistics, Catch

FERNHOLZ, W. B. 1968. Mississippi River Commercial Fishing Statistics, 1967. Wisc. Dept. Nat. Res., Bur. Fish Manage. Madison, WI. 21 p.

Abstract: The Mississippi River Commercial Fishing Statistics are compiled annually from information received from commercial fishermen who are required to submit catch reports monthly. Each fisherman must file a report with the La Crosse office stating the pool fished, kinds of gear used, the amount and species of fish taken, and other pertinent information relative to his operation.

This system of manatory reporting has been in use since 1959, and has proven satisfactory in obtaining data in which the status of the overall fishery and long and short term trends can be determined.

The estimated value of th catch is based on the annual average price paid at fish markets in Lynxville, Pepin and La Crosse, Wisconsin, and Lansing, Iowa.

Keywords: Commercial fishing, Statistics, Wisconsin, Harvest

FERNHOLZ, W. B. 1969. Mississippi rivers commercial fishing statistics, 1968. Wisc. Dept. Nat. Res., Bur. Fish Manage. 27 p.

Abstract: The Mississippi River Commercial Fishing Statistics are compiled annually from information received from commercial fishermen who are required to submit catch reports monthly. Each fisherman must file a report with the La Crosse office stating the pool fished, kinds of gear used, the amount and species of fish taken, and other pertinent information relative to his operation.

This system of mandatory reporting has been in use since 1959, and has proven satisfactory in obtaining datta in which the status of the overall fishery and long and short term trends can be determined.

The estimated value of the catch is based on the annual average price paid at fish markets in Lynxville, Pepin and La Crosse, Wisconsin, and Lansing, Iowa.

Keywords: Commercial fishing, Statistics, Wisconsin, Iowa, Harvest

FERNHOLZ, W. B. 1970a. Mississippi Rivers commercial fishing statistics, 1969. Wisc. Dept. Nat. Res., Bur. Fish. Manage. 24 p.

Abstract: The Mississippi River Commercial Fishing Statistics are compiled annually from information received from commercial fishermen who are required to submit catch reports monthly. Each fisherman must file a report with the La Crosse office stating the pool fished, kinds of gear used, the amount and species of fish taken, and other pertinent information relative to his operation.

This system of mandatory reporting has been in use since 1959, and has proven satisfactory in obtaining data in which the status of the overall fishery and long and short term trends can be determined.

The estimated value of the catch is based on the annual average price paid at fish markets in Lynxville, Pepin, and La Crosse, Wisconsin, and Lansing, Iowa.

Keywords: Commercial fishing, Statistics, Wisconsin, Harvest

FERNHOLZ, W. B. 1970b. Mississippi River commercial fishing statistics, 1970. Wisc. Dept. Nat. Res., Bur. Fish. Manage. 25 p.

Abstract: The Mississippi River Commercial Fishing Statistics are compiled annually from information received from commercial fishermen who are required to submit catch reports monthly. Each fisherman must file a report with the La Crosse office stating the pool fished, kinds of gear used, the amount and species of fish taken, and other pertinent information relative to his operation.

This system of mandatory reporting has been in use since 1959, and has proven satisfactory in obtaining data in which the status of the overall fishery and long and short term trends can be determined.

The estimated value of the catch is based on the annual average price paid at fish markets in Lynxville, Pepin, and La Crosse, Wisconsin, and Lansing, Iowa.

Keywords: Commercial fishing, Statistics, Wisconsin, Iowa, Harvest

FERNHOLZ, W. B. 1971. Mississippi River Commercial Fishing Statistics, 1971. Wisc. Dept. Nat. Res., Bur. Fish. Manage. 24 pp.

Abstract: An increase in total catch of rough fish occurred from 1970 to 1971. The months that produced the largest harvest were August, June, January, July, and December. Carps comprised 66% of the total catch. The catch value remained fairly stable. The number of commercial fishermen remained about the same.

Keywords: Commercial fishing, Statistics, Wisconsin, Harvest

FERNHOLZ, W. B. 1977a. Mississippi River Special Fall Tailwater Sport FIshing Creel Census in Pools 7, 8 and 9. Wis. Dept. Nat. Res., Fish Div. 1975-76. Sum. Rept. No. 1. 3 pp.

Abstract: The objectives of this study were to evaluate the fishing pressure and harvest and to provide information on the angler, the catch, and the relationship of various factors to the catch.

To examine the impact on the harvest of large game fish of a controversial bait manufactured by Heddon with the trade name "Sonar." Concern has been expressed that sonar may be exceedingly effective in catching large walleye and sauger.

The creel census clerk contacted fishermen in two of the tailwater areas during each eight-hour work day and recorded lengths of all walleye and sauger in the catch. In addition, weights were taken of a representative sample of walleye and sauger to determine an average weight for each species.

To insure a uniform and random census, the work schedule consisted of two consecutive census days followed by one day off, with rotation between morning hours (7:45 a.m. - 11:45 p.m.) and afternoon hours (12:30 p.m. - 4:30 p.m.) and between pools.

All data was segregated by type of fishing (boat, bank, barge), method of fishing (still, cast, multiple), and month (October, November).

A total of 1,614 fishermen of which 87.1 percent were male were contacted during the census. The average age for all anglers was 50.0 years.

Anglers traveling less than 50 miles made up 34.6 percent of the total anglers. Over 50 percent of the anglers traveled more than 100 miles to fish the tailwater areas.

Keywords: Creel census, Sport fishing, Tailwater, Pools 7, 8, and 9

FERNHOLZ, W. B. 1977b. Northern Pike Spawning Habitat Studies in Marahea of the La Crosse River and Black River near La Crosse, Wis. Wis. Dept. Nat. Res. Fish Div. Sum. Rept. No. 2. 5 pp.

Abstract: During 1974, fyke nets were used to capture spawning, adult northern pike migrating into the following marsh areas: Wattenburg Marsh on the Black River west of Onalaska, Car Street Marsh on the Black River west of C., M., St. P., and P. railroad terminal and La Crosse Marsh adjacent to Lang Drive. Two additional marshes were netted in 1975. One is located north of the La Crosse Marsh.

Northern pike captured were finclipped and released. Population estimates of northern pike utilizing individual marshes were calculated using Schnabel's formula.

In 1974, three criteria were used to verify spawning habitat. These were the presence of adult northern pike extruding eggs or milt, recovery of eggs deposited on submerged sedge type vegetation, and the capture of fry. The capture of spawning northern pike, deposited eggs and free swimming fry, collected at all localities during 1974, indicated that the presence of ripe adults is sufficient evidence for verifying northern pike spawning habitat.

Northern pike eggs were collected using dip nets. The fry were captured with a fine mesh seine.

Keywords: Habitat, Northern pike, Spawning, Black River

HAZLETON ENVIRONMENTAL SCIENCES

FERNHOLZ, W. B. 1977c. Five-Year Summary of Boomshocking in the Tailwater of Pool 7, Mississippi River. Wis. Dept. Nat. Res. Fish Div. 1975-76 Sum. Rept. No. 3, 9 pp.

Abstract: The objectives of this study were to determine if factors other than the number of fish present affect the walleye and sauger sport fishery and to note the condition of spawning walleye and sauger.

Fish were collected using electrofishing gear along a defined length of shoreline on both sides of the river, approximately 1.50 miles in Wisconsin and 1.75 miles in Minnesota. The length of time spent in covering the sampling area varied somewhat with the number of fish observed and netted, with collections made between 8:00 p.m. and 1:00 a.m. Samples were taken once or twice per week during the months of April and May. An attempt was made to net all fish stunned by the shocker except that numbers were estimated where very large quantities of fish other than walleye and sauger appeared. Lengths of all walleye and sauger were taken in addition to recording their numbers. The condition of mature fish in relation to spawning was also noted. Physical parameters recorded included air and water temperatures, weather conditions, river stage, and general water turbidity.

Keywords: Electroshocking, Tailwater, Pool 7, Walleye, Sauger

FERNHOLZ, W. B. 1977d. Northern Pike Spawning Study, Pool 8. Wis. Dept. Nat. Res. Fish Div. 1975-76. Sum. Rept. No. 4. 1 pp.

Abstract: Many marshy and low lying areas in the Mississippi River flood plain area are being filled and otherwise, degraded. Northern pike are known to require such habitat for spawning areas, however, there is very little documentation by site of this activity. Spawning documentation is needed to protect these natural northern pike marshes from further encroachment. This has been accomplished for two major spawning areas on the lower Black River and one ont he La Crosse River. The proposed further investigations would expand these investigations into areas with probable spawning habitat in the Mississippi River pools bordering La Crosse. Particular attention will be given to any sites threatened by dredge spoil from navigation channel maintenance which show potential as spawning areas.

When water temperatures or sample boom shocking indicate that northern pike are moving into the marshes, nets will be set to capture the spawning adults. Captured northern pike will be weighed, measured, sexed, fin clipped, and returned to the water. Netting will continue until ripe northern pike cease to enter the catch. An attempt will be made to determine the size of the spawning population utilizing each site. Further attempts will be made to locate and identify northern pike eggs and fry in those areas where spawning activity is observed or suspected.

Keywords: Spawning, Pool 8, Northern pike

FERNHOLZ, W. B. 1977e. An Evaluation of Deep Water Trap Nets as Commercial Gear in Pool 4A (Lake Pepin), Mississippi River. Wis. Dept. Nat. Res. Fish Div. 1975-76. Sum. Rept. No. 5. 9 pp.

Abstract: The objective of this study is to determine: (1) if deep water trap nets would be an effective addition to the commercial fishing in Pool 4A (Lake Pepin) to harvest freshwater drum, (2) their compatibility with other uses of the area, particularly sport fishing, and (3) soft and hard meat in freshwater drum by fat analysis.

A commercial operator was contracted by the Department of Natural Resources to construct nets and conduct the fishing. Department personnel monitored catches and recorded data. Fishing was done under the ice. Mesh sizes were 3-1/2 and 5 inches stretch. Visual and verbal observations were made to determine the compatibility of trap nets with other lake uses. Samples of drum caught from Lake Pepin and Pool 8 were analyzed for fat content, moisture content, and growth rate.

Keywords: Commercial fishing, Pool 4A, Lake Pepin, Freshwater drum, Catch

FERNHOLZ, W. B. 1977f. Pool 8 Gill Net Monitoring. Wis. Dept. Nat. Res. Fish Div. 1975-76. Sum. Rept. No. 6. 3 pp.

Abstract: The objectives of this study were to determine the extent of game fish and waterfowl loss due to gill netting and compare the losses to the gill net commercial harvest and to determine management regulations for gill net use.

Department personnel monitored 213,235 feet of gill net in Pool 8 from August 1974 through February 1976. Major commercial fish netted were carp (4,473 fish), buffalo (441 fish), and freshwater drum (198 fish). Other commercial species included gar, carpsuckers, redhorse, suckers, catfish, dogfish, mooneye, gizzard shad, and turtles. Northern pike composed the majority of the gam fish netted with 128 fish. Other game fish included sunfish, largemouth bass, walleye, and sauger. Three waterfowl were taken in monitored gill nets and consisted of one canvasback and two coots. Other non-saleable fish included catfish under the 20-inch size limit, a few paddlefish, shovelnose sturgeon, and bullhead.

Keywords: Pool 8, Catch, Fish

FERNHOLZ, W. B. 1977g. Contract Gill Netting - Pool 7. Wis. Dept. Nat. Res. Fish Div. 1975-76. Sum. Rept. No. 7. 1 pp.

Abstract: This study insured the maximum harvest of rough fish, that is compatible with preventing excessive losses of large game fish.

A two-year study of the Pool 7 gill net fishery from April 1972 indicated when and where the incidental catch of large game fish was most significant. Winter catches were found to be highly variable for both commercial and sport species. The game fish involved were mainly large northern pike and largemouth bass. Long sets (maximum of 96 hours between lifts) and apparent repeated capture of the same individual fish resulted in high mortalities. In some cases exceptionally large catches of rough fish were made with few or no game fish taken. Contract supervision provides the opportunity to be aware of problem game fish catches if and when they appear, and require nets to be removed from those areas.

Contract provisions limited the length of set to 48 hours and require gill netters to inform the department of their net lifting schedule in advance, and authorize the supervisor to require that nets be taken out of areas where considerable numbers of game fish are repeatedly taken.

Keywords: Pool 7, Catch, Fish

FERNHOLZ, W. B. 1977h. Mississippi River PCB Fish Collection. Wis. Dept. Nat. Res. Fish Div. 1975-76. Sum. Rept. No. 8. 2 pp.

Abstract: A collection of approximately 400 fish samples from five stations on the Mississippi River was made in 1975. Analysis of 93 of these samples for polychlorinated biphenyls (PCBs) showed few fillets exceeding 5 parts per million (maximum ppm for PCBs allowed by U.S. Food and Drug Administration in edible portion of market fish). Only 11 of the 93 samples exceeded 5 ppm (4 of these were carp). Direct conclusions should not be drawn from data results due to differences in sizes of fish, variation in fish species, and portions of fish taken for analysis in the 1970, 1973, and 1975 surveys.

Keywords: Fish, Pesticides

FERNHOLZ, W. B. 1977i. Twelve-foot channel study. Wis. Dept. Nat. Res. Fish Div. 1975-76. Sum. Rept. No. 9. 1 pp.

Abstract: In 1968 the U.S. Army Corps of Engineers activated a proposal to establish a 12-foot navigation channel on the Upper Mississippi River. Their proposal called for four alternatives in each pool as follows:

1. 3 feet of dredging.
2. 2 feet of dredging and a 1 foot rise in pool elevation.
3. 1 foot of dredging and a 2 foot rise in pool elevation.
4. A 3 foot rise in pool elevation.

Based on existing data and knowledge of the Mississippi River, each alternative was to be evaluated and the alternatives with least environmental damage would be recommended for each pool.

Keywords: Twelve-foot channel, Dredging

FERNHOLZ, W. B. 1977j. Evaluation of Sonar Sounding Equipment. Wis. Dept. Nat. Res. Fish Div. 1975-76. Sum. Rept. No. 10. 8 pp.

Abstract: The purpose of this study was the evaluation of sonar sounding equipment for use as a commercial fishing gear on the Upper Mississippi River and to determine if this gear could assist the commercial fishermen in the

location of rough fish to increase gear efficiency and harvest. The evaluation of parallel scanning in shallow (2 to 7 feet) weed areas.

Contacts were made with local commercial fishermen to accompany them during seining operations. Preparations were made to scan the area before and during seining. Recordings were kept of the print-outs to compare with the type and package of fish captured. Trail runs were made in Lake Pepin (Pool 4A) in 10 to 40 feet, in Pool 8 (10 to 25 feet), and Lake Onalaska (Pool 7) 2 to 7 feet of water to compare the effectiveness of this unit between deep and shallow waters.

The techniques employed for scanning a known seining area or searching for schools of fish consisted or positioning the transducer at a location where the entire area could be scanned (360°). Once locating the fish the width or horizontal "thickness" through the fish can be estimated. The length of the school can be approximated by shooting from different positions provided the fish do not more too fast.

Keywords: Remote sensing, Commercial fishing

FERNHOLZ, W. B. 1977k. Nine-foot channel maintenance surveillance. Wis. Dept. Nat. Res. Fish Div. 1975-76. Sum. Rept. No. 12. 17 pp.

Abstract: This study will monitor the U.S. Army Corps of Engineers 9-foot channel maintenance and operations project and recommend dredge spoil disposal sites in areas out of the flood plain where feasible and areas where a beneficial use has been determined or areas in the flood plain of least environmental damage.

Keywords: Nine-foot channel, Dredging

FERNHOLZ, W. B. 19771. Analysis of Trends in the Commercial Catfish Fishery of the Mississippi River, Pool 7-12. Wis. Dept. Nat. Res. Fish Div., 1776-77. Sum. Rept. No. 1. 4 pp.

Abstract: The catfish fishery of Pools 7, 8, 10, 11 and 12 show an increasing harvest trend. The harvest trend in Pool 9 is decreasing. The CPUE of the major gear in Pool 7 (setline) shows an increasing trend. The CPUE of the major gear in Pool 9 (trap nets) shows a decreasing trend. This leads to the conclusion of over fishing in Pool 9.

Two year classes are predominate in the catch of both Pools 7 and 9. In Pool 7, harvest is dominated by Age V fish in the spring and Age IV in the summer. Greater than 30% of the catch is greater than Age V. In Pool 9, Age IV dominates the spring catch with Age III the summer catch. Only 7% of the catch is greater than Age V.

The greatest percent of the catfish are not mature until Age IV. The establishment of a 15" size limit would protect fish to the size of maturity, thus insuring recruitment to the population. A 15" size limite presently exists in Pool 7 where a good age distribution of catfish exist. This lends stability to a fishery, in case of a year class failure. This is not the case in Pool 9. To increase the size limit to 15" in Pool 9 (Wisconsin-Iowa waters) would reduce the number of fish caught but the pounds harvested per year would increase, with exception during the first year of change. This is in contract to a 38% reduction in total pounds of harvest by closure of the season during the prior to spawning.

Keywords: Commercial fishing, Pools 7-12, Catfish

FERNHOLZ, W. B. 1977m. Winter Sonar Scanning - Pool 7, Mississippi River. Wis. Dept. Nat. Res., Fish Div., 1976-77. Sum. Rept. No. 2. 2 pp.

Abstract: Under-ice observations of fish in Pool 7 of the Mississippi River was conducted during a winter with extremely low water flow. Schools of fish, located, were primarily associated with wing dams. Few fish were observed in the main channel or scour areas on the outside bend of the channel. Schooled fish were highly mobile and sensitive to on-ice vibrations. Problems associated with winter scanning were the inability to identify fish species and the determination of vertical location and exact school size. The safety factor of using a snowmobile when warm weather prohibits the use of an airboat type craft is a severe limitation to this technique.

Keywords: Remote sensing, Pool 7, Fish, Ice

FERNHOLZ, W. B. 1977n. Pool 8 Gill Net Monitoring. Wis. Dept. Nat. Res., Fish Div., 1976-77. Sum. Rept. No. 3. 4 pp.

Abstract: This study determined the losses of gamefish and waterfowl caught incidentally during commercial gill net operations. It will also make recommendations concerning the use of commercial gill nets.

The past 2 years of gill net monitoring indicates that present commercial fishing operations are not adversely affecting northern pike populations in Pool 8. However, it should be noted that low water levels, particularly this spring, prevented gill netting in many areas that are known northern pike spawning marshes.

Although the present numbers of northern pike killed in commercial gill nets does not significantly affect the population, these dead northern pike can cause public relations problems. The modal size of northern pike captured is 36 inches. These are trophy fish for the sport fisherman. The site of dead of dying northern pike of this size causes conflicts between sport and commercial fishermen.

Keywords: Pool 8, Fish, Sampling, Commercial fishing, Northern pike

FERNHOLZ, W. B. 1977o. Pool 8 Northern Pike Spawning Study, March 23, 1976 - May 11, 1976. Wis. Dept. Nat. Res., Fish Div., 1976-77. Sum. Rept. No. 4. 5 pp.

Abstract: Adult northern pike were captured using fyke nets set in possible spawning areas of Pool 8. Captured northern pike were then measured (total length), sexed, and fin clipped (Table 1). The sex of ripe fish was determined by the presence of roe or milt. Northerns were fin clipped to determine the number of returns in the fyke nets for a population estimate. Population estimates were calculated with Schnabel's formula.

Egg sampling began toward the end of netting operations and continued after all nets were removed. Eggs were taken using fine mesh dip nets worked among flooded vegetation.

Fry sampling started April 22, 1976, utilizing a fine mesh seine. Seining was conducted in areas of flooded vegetation in water approximately 1.5 to 3.5 feet deep.

Spawning activity was documented by the collection of ripe, adult fish (readily extruding mile or roe), free eggs on submerged vegetation, and the collection of fry in the sampling areas.

Keywords: Pool 8, Northern pike, Spawning, Sampling

FERNHOLZ, W. B. 1977p. Pool 8 Northern Pike Spawning Study, March 26, 1977 - May 19, 1977. Wis. Dept. Nat. Res., Fish Div., 1976-77. Sum. Rept. No. 5. 4 pp.

Abstract: To document spawning activity, adult northern pike were captured with fyke nets set in representative spawning areas surrounding Goose Island. Metted northerns were measured (total length) and sexed. Sex was determined by the presence of roe or milt.

Egg sampling began toward the end of netting operations and continued after all nets were removed. Sampling was done using fine mesh dip nets worked in emergent vegetation.

Sampling for fry occurred on May 19, 1977 using a 50 foot fine mesh (1/8") minnow seine. Seining was done in fringe areas near net sets in water 1.5 to 4.0 feet deep.

Keywords: Pool 8, Northern pike, Spawning, Sampling

FERNHOLZ, W. B. 1977q. Fish Species Captured in Fyke Nets Near Goose Island (River Mile 690-693) During the Spring of 1977. Wis. Dept. Nat. Res., Fish Div., 1976-77. Sum. Rept. No. 6. 2 pp.

Abstract: Twelve, 3 foot diameter fyke nets were set in representative spawning areas for northern pike. Areas netted included backwater areas fringed with stands of reed canary grass, sedge grass, bulrush, and cattail north and east of Goose Island.

In addition to the 596 northern pike netted, 23 other fish species were also captured.

Black crappies were most abundant with a catch per unit effort of 21.1 fish per net day (average). A total of 2,317 crappies were captured ranging in size from 2.5 to 15.0 inches. Of particular interest is the number of large fish present in the sample.

Keywords: Fish, Catch, Sampling

FERNHOLZ, W. B. 1977r. Contract Gill Netting - Pool 7. Wis. Dept. Nat. Res., Fish Div., 1976-77. Su. Rept. No. 7. 1 pp.

Abstract: A two-year study of the Pool 7 gill net fishery from April 1972, indicated when and where the incidental catch of large game fish was most significant. Winter catches were found to be highly variable for both commercial and sport species. The game fish involved were mainly large northern pike and largemouth bass. Long sets (maximum of 96 hours between lifts) and apparent repeated capture of the same individual fish resulted in high mortalities. In some cases, exceptionally large catches of rough fish were made with few or no game fish taken. Contract supervision provides the opportunity to be aware of problem game fish catches if and when they appear and require nets to be removed from these areas.

The chief area of concern is Lake Onalaska. It supports significant game fish populations and receives heavy sport fishing pressure.

Keywords: Pool 7, Catch, Sampling, Fish

FERNHOLZ, W. B. 1977s. A Winter Study of Dissolved Oxygen Levels in Lake Onalaska, the Trempealeau Lakes, and Shady Maple. Wis. Dept. Nat. Res., Fish Div., 1976-77. Sum. Rept. No. 8. 3 pp.

Abstract: This study monitored the dissolved oxygen content of selected backwater areas of the Mississippi River under adverse environmental conditions. The winter of 1977 was the most severe in recent years. Drought conditions existing during 1976 caused below normal flow levels.

Predetermined stations were sampled for dissolved oxygen at three to four week intervals. Holes were drilled with a Jiffy power auger and oxygen values determined by a Yellow Springs Institute Model 54 dissolved oxygen meter. Readings were initially taken just under the ice and .5 foot above the bottom. During the course of the study, oxygen values were noted to change considerably through 1.0 foot intervals. Subsequent readings were taken at 1.0 foot increments.

Keywords: Chemistry, Lake Onalaska

FERNHOLZ, W. B. 1977t. Mississippi River Spring Tailwater Sport Fishing Creel Census in Pool 7, 8 and 9 - March 1, 1976 through April 30, 1976. Wis. Dept. Nat. Res., Fish Div., 1976-77. Sum. Rept. No. 9. 11 pp.

Abstract: This program will evaluate the fishing pressure and harvest and to provide information on the angler, the catch, and the relationship of various factors to the catch and examine the impact on the harvest of large game fish on the controversial bait manufactured by Heddon with the trade name "Sonar." Concern has been expressed that sonar may be exceedingly effective at catching large walleye and sauger.

Keywords: Creel census, Tailwater, Fish, Pools 7, 8, and 9

FERNHOLZ, W. B. 1977u. Mississippi River Fall Tailwater Sport Fishing Creel Census in Pools 7, 8, and 9 - October 1, 1976 through November 30, 1976. Wis. Dept. Nat. Res., Fish Div., 1976-77. Sum. Rept. No. 10. 13 pp.

Abstract: The creel census clerk contacted fishermen in 2 of the tailwater areas during each 8 hour work day and recorded lengths of all walleye and sauger in the catch.

To insure a uniform and random census, the work schedule consisted of 2 consecutive census days followed by 1 day off, with rotation between morning hours (7:45 a.m. - 11:45 a.m.), afternoon hours (12:30 p.m. - 4:30 p.m.), and between pools.

All data was segregated by type of fishing (boat, bank, and barge), by methods used (still, casting, trolling, and multiple methods), and by the months of October and November. In addition, the data was analyzed separately by the 3 pools, then compared collectively.

Keywords: Creel census, Fish, Tailwater, Pools 7, 8, and 9

FERNHOLZ, W. B. 1977v. Mapping the Bottom Configurations and Water Depths in the Mississippi River. Wis. Dept. Nat. Res., Fish Div., 1976-77. Sum. Rept. No. 11. 11 pp.

Abstract: This project will determine a fast and effective method for mapping the bottom configurations and water depths of the Mississippi River. The Army Corps of Engineers presently maps only the areas of the Mississippi River directly associated with channel maintenance for commercial navigation.

It will also locate deep areas that may be utilized as wintering locations for commercial and sport fish. Such areas are scour holes associated with wing dams, closing dams, and lock and dams.

Keywords: Geology, River bottom

FERNHOLZ, W. B. 1977w. Survey of Mussels in the Upper Mississippi River - Pools 3 through 8. Wis. Dept. Nat. Res., Fish Div., 1976-77. Sum. Rept. No. 12. 3 pp.

Abstract: This survey will determine the location of mussel beds, species composition and relative abundance, characterize suitable mussel habitat, compare mussel populations between pools and to a previous Wisconsin DNR survey conducted during 1965, and monitor the commercial mussel harvest.

A 10 foot dovetail brail, with 200 hooks, is fished for 5 minutes (approximately 300 feet) in a downstream direction over selected areas. The location of the brail drags are recorded on aerial photographs (1973) and navigation maps. Water depth and bottom type are recorded at the beginning, and end of the run. Mussels caught, are identified, measured for length and width (cm) and checked for sexual maturity. A maximum of two specimens per species, viscera excluded, are catalogued per run in a reference collection. A diversity index, species importance value and length frequency and mean size per species will be compared between pools and to the 1965 mussel survey data. Commercial shell buyers have been provided with a volunteer questionnaire indicating total tonnage, species harvested, location of clamming operations, quantity of equipment leased, price paid per ton and principal market. In addition, species composition and length-width measurements will be subsampled monthly from the commercial shell piles.

Keywords: Mussels, Pools 3-8, Upper Mississippi River, Survey

FERNHOLZ, W. B. 1977x. Collection of Fish Species from Mississippi River for PCB Analysis. Wis. Dept. Nat. Res., Fish Div., 1976-77. Sum. Rept. NO. 13. 2 pp.

Abstract: Department personnel collected eight species of fish from Pool 8 and eleven species from Pool 9. Sampling was done with an electroshocker operated at 230 Volts and 10 amps. Shocking was conducted during both daylight and nighttime hours. Habitat shocked include riprap, backwater weed beds, sand areas, wing dams, and tailwaters. Whole fish samples were either frozen or stored on ice and sent to the Department's Bureau of Water Quality.

Keywords: Fish, Pools 8 and 9, Pesticides

FERNHOLZ, W. B. and V. E. CRAWLEY. 1972. Mississippi River Commercial Fishing Statistics 1972. Wisc. Dept. Nat. Res., Bur. Fish. Wildl. Manage. 24 p.

Abstract: The Mississippi River Commercial Fishing Statistics are compiled annually from information received from commercial fishermen who are required to submit catch reports monthly. Each fisherman must file a report with the La Crosse office stating the pool fished, kinds of gear used, the amount and species of fish taken, and other pertinent information relative to his operation.

This system of mandatory reporting has been in use since 1959, and has proven satisfactory in obtaining data in which the status of the overall fishery and long and short term trends can be determined.

The estimated value of the catch is based on the annual average price paid at fish markets in Lynxville, Pepin, and La Crosse, Wisconsin, and Lansing, Iowa.

Keywords: Commercial Fishing, Statistics, Wisconsin, Harvest

FERNHOLZ, W. B. and V. E. CRAWLEY. 1973. Mississippi River Commercial Fishing Statistics, 1973. Wisc. Dept. Nat. Res., Bur. Fish. Wildl. Mange. 23 pp.

Abstract: The Mississippi River Commercial Fishing Statistics are compiled annually from information received from commercial fishermen who are required to submit catch reports monthly. Each fisherman must file a report with the La Crosse office stating the pool fished, kinds of gear used, the amount and species of fish taken, and other pertinent information relative to his operation.

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Keywords: Commercial Fishing, Statistics, Wisconsin, Harvest

FERNHOLZ, W. B. and V. E. CRAWLEY. 1974. Mississippi River Commercial fishing statistics, 1974. Wisc. Dept. Nat. Res., Bur. Fish. Wildl. Manage. Madison, WI. 25 pp.

Abstract: Report was covering total catch of fish in 1974 and the gear used. Heaviest catch was in January and April. Carp comprised 62% of the total catch. Total catch in 1974 was lower than 1873.

Keywords: Commercial fishing, Statistics, Wisconsin, Harvest

FERNHOLZ, W. B. and V. E. CRAWLEY. 1975. Mississippi River Commercial fishing statistics, 1975. Wis. Dept. Nat. Res., Bur. Fish. Wildl. Manage. Madison, WI. 23 pp.

Abstract: The total catch of rough fish in the Wisconsin portion of the Mississippi River in 1975 decreased from the previous year. The months producing the largest catch were August and January. Carp comprised 53% of the total catch.

Keywords: Statistics, Commercial fishing, Harvest, Wisconsin

FERNHOLZ, W. B. and V. E. CRAWLEY. 1976. Mississippi River Commercial Fishing Statistics, 1976. Wisc. Dept. Nat. Res., Bur. Fish. Manage.

Abstract: Reports total catch in 1976. The largest catches were in August and July. Carp comprised 64% of catch. The total catch increased over 1975.

Keywords: Commercial fishing, Statistics, Wisconsin, Harvest

FERNHOLZ, W. B. and A. FINKE. 1962-1963. Annual reports, Mississippi River commercial fishing statistics. Fish Manage. Div., Wis. Cons. Dept. Unpub. mimeo.

Abstract: Mississippi River commercial fishing statistics are compiled from individual reports obtained from licensed commercial fishermen. Tables are presented which summarize total catch in pounds by species and their value, total catch in pounds with all gear combined, catch by gear, number of commercial fishermen, and monthly summaries.

Keywords: Fish, Creel census, Statistics, Catch

FERNHOLZ, W. B. and W. THUR. 1977. Upper Mississippi River recreation facilities inventory. Wisc. Dept. Nat. Res., Bur. Fish. Manage. Rept. No. 93 Madison, WI.

Abstract: An inventory of the recreational facilities of the Wisconsin waters of the Mississippi River was conducted in 1976. Results are presented and compared to those found in 1968-69 inventory. Individual inventory forms and maps locating each facility are presented in appendices.

Keywords: Recreation

FERNHOLZ, W. B., G. J. VAN DYCK III, and C. W. THREINEN. 1970. A summary of recreational attractions and facilities on the Mississippi River in Wisonsin. Fish. Manage. Rept. No. 36. Wisc. Dept. Nat. Res., Bur. Fish. Manage., Madison, WI.

Abstract: In 1968-69 an inventory of the recreational attractions and facilities on the Mississippi River in Wisconisn was provided. The inventory was part of the basic data collected for an evaluation of channel improvements proposed by the Corps of Engineers. Since the data provided has general interest and can be conveniently used for planning purposes it has been summarized in this report.

Attractions and facilities summarized include boat rental and service, boat launching and access, swimming beaches, campsites, picnic areas, trails, scenic features (Bluffs). These were summarized pool by pool and county by county.

Keywords: Recreation

FIEDLER, R. H. 1933. Fishery industries of the U.S., 1932. Rept. U.S. Comm. Fish. for fiscal year 1933. App. 3: 149-419.

Abstract: The statistical work of the Division in 1932, as in former years, included the collection and dissemination of statistics on the catch of fishery products and the gear employed in making the catch and statistics of related fishery industries. In the former group are statistics that are intended for the use of the fishery biologist upon which to base conservation measures. They are also valuable for economic purposes. This is especially true of statistics of the landings of fish at principal fishing ports, which are published monthly. In the second group are statistics that are of use mainly for economic or trade purposes. These include statistics of the manufactured fishery products and byproducts of the United States, cold-storage holdings

of fish and amounts of fish frozen in the United States, marine-animal oil production, and similar statistics.

Keywords: Fishing, Statistics

FIEDLER, R. H. 1935. Fishery industries of the U.S., 1934. Rept. U.S. Comm. Fish. for fiscal year 1935, App. 2:75-330.

Abstract: This report constitutes a summary of the activities of the Division of the Fishery Industries as well as an annual review for 1934 on fishery statistics of the United States.

Keywords: Fishing, Statistics

FIEDLER, R. H. 1936. Fishery industries of the U.S., 1935. Admin. Rept. No. 24. U.S. Comm. Fish. for fiscal year 1936, App. 2: 73-348.

Abstract: This report constitutes a summary of the activities of the Division of Fishery Industries as well as an annual review of fishery statistics. As its name indicates, this Division of the Bureau is concerned with the activities and welfare of the commercial fishery and fishery industries, the trade in fishery products, and the fish canning and preserving industries. Its functions include the collection and publication of fishery statistics, the conducting of market surveys, the prosecution of research designed to solve the technical problems of the industry, and the dissemination of authoritative and practical information to the fishery industries and the public. Results of technical investigations and marketing studies are published in separate documents as each project is completed. The information obtained from statistical surveys is published in part 2 of this report, which includes all the detailed statistical information that has become available since the issuance of the previous report, together with such summarized statements and interpretations of the statistics as are deemed significant and useful.

Keywords: Fishing, Statistics

FIEDLER, R. H. 1938a. Fishery industries of the U.S., 1936. Admin. Rept. No. 27. U.S. Comm. Fish. for fiscal year, 1937, App. 1:1-276.

Abstract: This report constitutes a summary of the activities of the Division of Fishery Industries as well as an annual review of fishery statistics. As its name indicates, this Division of the Bureau is concerned with the activities and welfare of the commercial fishery and fishery industries, the trade in fishery products, and the fish canning and preserving industries. Its functions include the collection and publication of fishery statistics, the conducting of market surveys, the prosecution of research designed to solve the technical problems of the industry, and the dissemination of authoritative and practical information to the fishery industries and the public. Results of technical investigations and marketing studies are published in separate documents as each project is completed. The information obtained from statistical surveys is published in part 2 of this report, which includes all the detailed statistical information that has become available since the issuance of the previous report, together with such summarized statements and interpretations of the statistics as are deemed significant and useful.

Keywords: Fishing, Statistics

FIEDLER, R. H. 1938b. Fishery industries of U.S., 1937. Admin. Rept. No. 32. U.S. Comm. Fish. for fiscal year 1938, App. 3: 151-460.

Abstract: This report constitutes a summary of the activities of the Division of Fishery Industries as well as a review of the fishery statistics collected by the Division during the past year. As its name indicates, this Division of the Bureau is concerned with the activities and welfare of the commercial fisheries and fishery industries and the fishermen and shoresmen engaged therein; the fish canning and preserving industries; and the trade in fishery products.

Keywords: Fishing, Statistics

FIEDLER, R. H. 1940. Fishery industries of U.S., 1938. Admin. Rept. No. 37. Comm. Fish. for fiscal year 1939, App. 3: 169-554.

Abstract: This report constitutes a summary of the activities of the Division of Fishery Industries as well as a review of the fishery statistics collected by the Division during 1938. As its name indicates, this

Division of the Bureau is concerned with the activities and welfare of the commercial fisheries and fishery industries and the fishermen and shoresmen engaged therein; the fish canning and preserving industries; and the trade in fishery products.

Keywords: Fishing, Statistics

FIEDLER, R. H. 1941. Fishery industries of U.S., 1939. Admin. Rept. No. 41. Comm. Fish. for fiscal year 1940, App. 3: 185-554.

Abstract: This report constitutes a summary of the activities of the Division of Fishery Industries, as well as a review of the fishery statistics collected by the Division in 1939.

Keywords: Fishing, Statistics

FIEDLER, R. H., J. R. MANNING and F. F. JOHNSON, 1934. Fishery industries of U.S., 1933. Rept. U.S Comm. Fish. for fiscal year 1934, App. 1: 1-237

Abstract: This report constitutes a summary of the activities of the Division of Fishery Industries as well as an annual review of fishery statistics of the United States. As its name indicates, this Division of the Bureau is concerned with the activities and welfare of the fishery industries including the commercial fisheries, the trade in fishery products and the fish canning and preserving industries. Its functions include the collection and publication of fishery statistics, the conducting of market surveys the prosecution of research designed to solve the technical problems of the industry and the dissemination of authoritative and practical information to the fishery industries and the public. Results of technological investigations and marketing studies are published in separate documents as each project is completed. The information obtained from statistical surveys is published in part 2 of this report, which includes detailed statistical information for the year 1932 that has become available since the issuance of the previous report together with such summarized statements and interpretations of the statistics as are deemed significant and useful.

Keywords: Fishing, Statistics

FINKE, A. H. 1964a. Three years of trawling in Lake Pepin, 1961-1963. Wisc. Cons. Dept., West Central Area, Invest. Memo. No. 19. Mimeo., unpublished. 19 p.

Abstract: Since 1958 the Wisconsin Conservation Department has been experimenting with small otter trawls as fish collecting devices on the Mississippi River. Initial studies were made in Pools 7 and 8 during 1958-60. It was concluded from these efforts that this gear was not well suited for use in the main channel of these pools because of wing dams, submerged snags, and other obstructions.

Lake Pepin appeared to offer ideal trawling conditions--relatively great depth of water and long stretches free of underwater obstacles. Trawling was begun in 1960 and continued through 1963. This report includes the work done during the summers of 1961-63.

Keywords: Lake Pepin, Fishing

FINKE, A. H. 1964b. Mississippi River sport fishing creel census in Pool 7, April 1, 1962-March 31, 1963. Wisc. Cons. Dept., West Central Area, Invest. Memo, No. 21. Mimeo, unpublished. 50 p. and Appendix.

Abstract: The objectives of this study, which was carried out in a similar manner in six additional pools by Minnesota, Iowa and Illinois under the auspices of the Upper Mississippi River Conservation Committee, were to determine characteristics of the sport fisherman, his catch, and the relationship of the fishery to various facets of river environment. A procedure was adopted based on a statistical creel census and a biological study of the sport fishes, and was set up in such a way that the study could be repeated in future years with comparable results. Plans call for a census of the river by the UMRCC at five-year intervals, so that trends and changes in the fishery and river usage can be detected.

Keywords: Pool 7, Sport fishing, Creel census

FINKE, A. H. 1964c. Mississippi River Electrofishing Survey in Pools 3 and 4 during 1963. Wisc. Cons. Dept., West Central Area, Invest. Memo, No. 20. unpublished. 28 p.

Abstract: An electrofishing survey was conducted during 1963 in Pools 3, 4A (Pool 4 above Lake Pepin), and 4L (Lake

Pepin) of the Mississippi River. This completed a survey, begun in 1960, of all pools between Dubuque, Iowa, and Prescott, Wisconsin.

The objectives of this survey were to determine fish populations and the navigation channel subhabitats frequented by the various species, and to investigate areas that might be used as permanent sampling stations for future survey work.

Keywords: Fishing, Iowa, Wisconsin, Pools 3 and 4, Lake Pepin, Survey, Habitat

FINKE, A. H. 1966a. A five-year summary of commercial fishing for carp, buffalo, sheepshead, catfish and bullhead on the Wisconsin Portion of the Mississippi River - 1960-1964. Fish Management Report No. 8 Wisc. Cons. Dept. Fish Manage. Madison, WI.

Abstract: Successful management of a fishery resource often relies on long-term trends in the fishery. These trends are neither evident from current catches nor from annual statistical reports. From time to time it is, therefore, desirable to review the annual statistics and to note the consistencies or inconsistencies of the data provided on an annual basis. This report makes extractions from the statistics of five recent years, 1960-1964 inclusive. By means of graphs, visual evidence of the nature of the fishery and trends in the fishery are made readily available for comparison and interpretation. Only the five most important species are included-- these made up 98.4 percent of the 23,944,000 pounds taken during the period 1960 through 1964. The value to the fishermen of these species during that period was approximately $1,475,000.

In addition to these five major species, over a dozen others entered into the commercial harvest. Among these minnow species, the most important were the redhorses and suckers, quillback or "white carp", and sand sturgeon. Mooneyes and goldeyes are occasionally important in the upper portion of the Mississippi River. Bowfins and gar are common in the river, but their value is so low that only a few thousand pounds are kept each year. A few hundred American eels are taken annually while fishing for catfish. This species is widespread but not common in the Mississippi River.

Keywords: Commercial fishing, Fish, Pools 6-15, Harvest, Statistics

FINKE, A. H. 1966b. Northern pike tagging study, Black River, La Crosse County, Wisconsin. Fish Management Rept. No. 7 , Wisc. Cons. Dept. Fish Manage. Div., Madison, WI.

Abstract: The northern pike is an important game fish in the Mississippi River and tributaries. However, little information is available concerning movement of this species, catch rates, and spawning areas in the Upper Mississippi River, particularly in the vicinity of La Crosse, Wisconsin. The purpose of this study was to obtain this information in the area of intensive sport fishing.

Keywords: Fish, Spawning, Survey, Pike, Movement

FINKE, A. H. 1966c. White bass taggin study: Upper Mississippi River. Fish Manage. Rept. No. 6, Wisc. Cons. Dept. Fish Manage. Div. Madison, WI.

Abstract: In recent years the white bass (Roccus chrysops) has become an increasingly important sport fish in the upper Mississippi River. Movements of this species in the Mississippi River are not well known, other than that it is presumed to be rather mobile. The primary purpose of this tagging study was to learn more about white bass movements. Other data sought were the suitability and effects of two types of tag on this species, and the rate of angler harvest.

Keywords: Fish, Survey, Upper Mississippi River, Movement, White bass, Harvest

FINKE, A. H. and R. C. HUBLEY, JR. 1963. Concentrations of fisherman on the Mississippi River as defined by aerial census, 1960-1962. Wisc. Cons. Dept., West Central Area Invest. Memo, No. 18. Mimeo., unpublished. 29 p.

Abstract: In an effort to delineate concentrations of sport fishermen on the Mississippi River, an aerial census was conducted intermittently from December 11, 1960 to September 3, 1962. During these flights, all types of recreational activity on the river were recorded. In this way the more heavily used portions of the Mississippi could be determined, and this knowledge could be applied to planning public access developments, future creel census studies, and determining general river usage by fishermen and others.

Keywords: Fishing, Creel census

FISCHTHAL, J. H. 1947. Parasites of northwest Wisconsin fishes. I. The 1944 survey. Trans. Wisc. Acad. Sci. Arts Lett., 37: 157-220.

Abstract: As a result of many inquiries into parasites found on game and pan fishes and the need for more knowledge on the distribution of the bass tapeworm a program was started for a complete survey of the parasites of Wisconsin fishes. The present paper is the first in a series of annual reports on a parasite survey of northwest Wisconsin fishes.

During this period fresh fishes were examined from 54 different lakes, streams, and natural and artificial bass rearing ponds as shown in Table 1. These fishes were collected for the most part by the use of fyke nets in lakes, and a common sense minnow seine in streams. Other means used for collecting fishes were electric shocking, line fishing, and poisoning with rotenone.

Keywords: Fish, Wisconsin, Parasites

FISCHTHAL, J. H. 1950. Parasites of northwest Wisconsin fishes. II. The 1945 survey. Trans. Wisconsin Acad. Sci. Arts Lett., 49(1): 87-113.

Abstract: In a survey of fish parasites during 1945 from 27 lakes and streams in northwest Wisconsin, 926 fishes representing 40 different species and subspecies were examined and 808 or approximately 87.2 percent were infected with at lease one species of parasite. The number of fish infected with each parasite from each water as well as the intensity of infection is presented for each species of fish examined. The larval parasites occurred most frequently and in more species of fishes than did the other development stages. The bass tapeworm, Proteocephalus ambloplitis, was in 9 [illegible] fishes; the black spot parasites, Neascus spp. in 25 species; the larval yellow grub, Clinostomum marginatum, in 15 species; anf the gill flukes (Gyrodactyloidea) in 18 species.

Keywords: Fish, Wisconsin, Parasites

FISHER, H. J. 1947. Fishing for a rugged living. Mo. Conserv. 8(7): 3-5.

Abstract: Commercial fishing in Missouri is limited to the Missouri, Mississippi, and part of the St. Francis rivers. Most commercial fish sold consist of carp, buffalo, flathead catfish and drum. Fishermen most often use a "John-boat" and tackle consisting of hoop-nets, trammel nets, lines and seines, with the hoop-net most popular.

Keywords: Commercial fishing, Missouri, Fishing

FISHER, H. J. 1951. Men, rivers, nets - and fish. Mo. Conserv. 12(6): 1-3.

Abstract: Commercial fishing is very important on the Mississippi and Missouri rivers. The main commercial fish caught are carp, catfish, and buffalo. The type of equipment favored varies, and so does effectiveness of each type. Some of the problems facing commercial fishermen are marketing, equipment, adverse conditions, and pollution.

Keywords: Missouri, Fishing, Commercial fishing

FISHER, H. J. 1956. Pollution and Missouri fishes. Missouri River. Mo. Conserv. 17(12): 6-7.

Abstract: The problem of pollution's effect on fishes is very serious. Oil, acid wastes, insecticides, sewage, and mine wastes are just some of the polluting substances which effect the breeding and feeding grounds of fishes. The toxic effects of these pollutants is also very serious.

Keywords: Fish, Missouri, Pollution

FISHER, H. J. 1962. Some fishes of the lower Missouri River. Am. Midl. Nat., 68(2): 424-429.

Abstract: From April through October, 1945, sixty species of fishes were taken on a fisheries and limnological survey of the Missouri River at 11 widely scattered stations located between the Iowa-Missouri state line and the confluence with the Mississippi River. The survey was conducted by the Conservation Commission with the co-operation of the University of Missouri. Methods of collection are discussed. Collecting stations are shown on a map. Dates of collections, species of fishes collected, and number of fishes of each species in the collections at each station are indicated in two tables.

Keywords: Fish, Missouri River

FLEENER, G. G. 1975. The 1972-1973 Sport fishery survey of the Upper Mississippi River, Upper Mississippi River Cons. Comm. 112 p.

Abstract: The sport fishery of seven navigation pools of the Upper Mississippi River was surveyed in 1972-1973 with uniform quidelines first used in 1962-1963. Characteristics of both the angler and the catch were recorded. Interviews and observations provided data for comparison with the two previous surveys, and provided a basis for management of this valuable fishery resource.

For all seven pools combined, the species most often sought by anglers were walleyes and saugers, followed by bluegills, crappies, and channel catfish.

Keywords: Sport fishing, Survey, Upper Mississippi River

FLEENER, G. G. 1976. Recreational use of pool 21, Mississippi River. Mo. Dept. Cons. Columbia, MO. 21 p.

Abstract: Recreational use of Pool 21, Mississippi River was estimated from September 2, 1973 to August 31, 1974 to provide information for present and future consideration in the management of this water resource. Recreational use was determined by interviewing departing visitors. Twenty-four stations were selected on the basis of known use patterns and assigned a weight which determined sampling frequency (non-uniform probability sampling technique). Estimates of use were extrapolated from the field data. The survey area included 18.3 miles of the Mississippi River (6,350 acres), and about 8,686 acres of public lands for a total of 15,036 acres.

An estimate of the recreational use in Pool 21 and the immediately adjacent area during this 1-year study was approximatley 386,600 visits or over 1,083,000 hours. Use clerks interviewed 4,330 recreationists that were involved in twenty-seven types of recreational uses.

Keywords: Recreation, Pool 21

FLEENER, G. G. and M. B. GOGEL. 1977. Guide to Recreational Facilities, Mississippi River, River Mile 857.7 (St. Anthony Parkway, Minnesota) to River Mile 1.0 (Fort

Defiance State Park, Illinois). Upper Mississippi River Conservation Committee.

Abstract: The Recreation and Water Use Section of the Upper Mississippi River Conservation Committee (UMRCC) and the Recreation Work Group of the Great River Environment Action Team (GREAT) jointly undertook an inventory of recreation facilities along the Mississippi River from Minneapolis, Minnesota to Cairo, Illinois during 1976 and 1977.

This publication includes a list of recreational facilities available by individual river pool as well as the unimpounded section from Alton, Illinois to the mouth of the Ohio River.

The maps provide a location of each site. The river mile at each site is included since many people also use the excellent Mississippi River navigation charts published by the U.S. Army Corps of Engineers.

Keywords: Recreation, Sport fishing

FLETCHER, B. P. and J. L. GRACE JR. 1977. Flow Conditions at Pumping Stations, Cairo, Illinois; Hydraulic Model Investigation. Army Engineer Waterways Experiment Station. Vicksburg, Miss. 67 p.

Abstract: The model study reported herein was conducted to evaluate the characteristics of inflow to the original design pump and to develop modifications required for improving the distribution of flow to the pump intakes. The study indicated the need for certain minor modifications to improve flow characteristics in the forebay and ensure satisfactory flow characteristics and pressures near the pump intakes. The major problems encountered were generated by the concentrated, submerged jet entering and passing through the forebay.

Keywords: Flow, Discharge, Lock, Development, Models, Ohio River, Illinois

FLIGER, R. 1961. Iowa's largest fishing hole. Iowa Conserv. 20(6): 137, 139, 141.

Abstract: The Mississippi River offers a wide variety of opportunities for Iowa fishermen. Hints on species and where to find and catch them is given. Wing dams are

excellent spots to catch fish because of their attraction to forage fish, crayfish, and insect larvae. Walleye and sauger are usually associated with deeper waters and heavy currents.

Keywords: Iowa, Fishing

FLINT, T. 1828. The history and geography of the Mississippi Valley. Cincinnati.

Abstract: A history of the states in the Mississippi Valley giving their geological history, climate, schools, antiquities, rivers, and cultural history.

Keywords: History

FLYNN, M. T. 1975. Primary production and chlorophyll a content of phytoplankton during 1973-1974 in pool No. 3 of the Upper Mississippi River near Red Wing, Minnesota. B. A. Thesis, St. Mary's College, Winona, MN. 73 p.

Abstract: Studies were initiated to determine the levels of chlorophyll "a" and primary productivity on the Upper Mississippi River in Pool No. 3 in the vicinity of Northern States Power Company's Prairie Island Nuclear Generator before and after it began commercial operation. From May 9, 1973, through November 9, 1974, measurements of temperautre, chlorophyll "a" concentration, phaeophytin, and gross primary productivity were gathered.

Chlorophyll "a" and phaeophytin concentrations were determined with the use of fluorometric techniques. Light and dark bottle methods were used to determine gross primary productivity. Maximum chlorophyll "a" concentrations were reached on July 26, 1973 and on August 1, 1974. Maximum primary productivity was reached on July 25, 1973 and on July 26, 1974. Higher average chlorophyll "a" concentrations were observed in 1974 than in 1973. In contrast, lower average gross primary productivity was observed in 1974 than in 1973. The effects of Northern States Power Company's Prairie Island Nuclear generator on chlorophyll "a" concentration and gross primary production seem to be very minimal.

Gross primary productivity and chlorophyll "a" concentration show no significant correlation with one another. Therefore, the use of chlorophyll "a" as an indication of gross primary productivity is of little value.

Keywords: Primary production, Phytoplankton, Pool 3

FORBES, S. A. 1888a. The food of the fishes of the Mississippi Valley. Trans. Am. Fish. Soc., 17: 1-17.

Abstract: It seems evident that the fishes most desirable as food for other kinds are those whose own food is not eaten by valuable species, but exists in practically inexhaustible supplies.

Keywords: Fish, Food habits

FORBES, S. A. 1888b. Notes on the food of the fishes of the Mississippi Valley. Trans. Am. Fish. Soc. 17: 37-66.

Abstract: The author reports on what our native fish eat. He has arranged the matter under the following general headings: (1) a general account of the food of the most important species and families of our native adult fishes; (2) a brief account of the food of the young; and (3) a summary statement of the food, so made as to exhibit (a) the kinds and relative importance of the principal competitions amoung fishes, and (b) the relative value to the principal species of fishes of the major element of their food.

Keywords: Fish, Food habits

FORBES, S. A. 1888c. On the food relations of freshwater fishes: a summary and discussion. Bull. Ill. St. Lab. Nat. Hist. 2(8), pp. 475-480.

Abstract: A study on the food relations of freshwater fishes which gives the kinds and relative importance of the food; food of the young; feeding habits; and list of objects detected in the food of fishes.

Keywords: Fish, Food habits

FORBES, S. A. and R. E. RICHARDSON. 1905. On a new shovelnose sturgeon from the Mississippi River. Bull. Ill. St. Lab. Nat. Hist. 7(4): 37-44.

Abstract: According to studies taken at Grafton, Ill. about one in five hundred of the shovelnose sturgeons taken in central Mississippi belong to this new species. A

description is given of this new species size, physical characteristics, and taxonomy.

Keywords: Sturgeon, Fish

FORBES, S. A. and R. E. RICHARDSON. 1909. The fishes of Illinois. Ill. Nat. Hist. Surv. 3: 357.

Abstract: A descriptive guide to the fish of Illinois with many pictures for identification and maps to show distribution. Life histories and food habits are also discussed.

Keywords: Fish, Illinois

FORBES, S. A. and R. E. RICHARDSON. 1920. The fishes of Illinois. (Second ed.) Ill. Nat. Hist. Surv., 357 pp.

Abstract: It is the purpose of this volume to furnish to those interested in Illinois fishes a reliable guide to a knowledge of the species, a careful account of their environment, a correct idea of the function and relative importance of the different species in the general system of aquatic life, and a fairly full sum - mary of their habits and utilities so far these are now known.

Keywords: Fish, Illinois

FORRETTE, J. E., JR. 1974. Comparative age and growth of sauger Stizostedion canadense (Smith) during 1972-1973 in pools 3 and 4 of Upper Mississippi River near Red Wing, Minn. St. Marys College, Winona, MN.

Abstract: From October 14, through November 12, 1972, and May 25 through August 8, 1973, saugers Stizostedion canadense (Smith) were netted in Pools 3 and 4 of the upper Mississippi River from the 801 mile marker to the 794 mile marker. Through use of gill nets and frame (trap) nets, 178 sauger were caught, two of which were discarded. Data was taken in terms of total length, total weight, and scale samples.

By utilizing the acetate-strip method of scale-pressing (Greenbank and O'Donnell, 1950) and by subsequently reading these impressions with a Model 2700 Eberbach microprojector (16 mm lens system) the back-calculated length at each annulus were determined. From this data

the average length at each age group were found, as well as the average annual increments. Average calculated total lengths at each age group for sauger in Pools 3 and 4 were found to lie between average total lengths reported from Lewis and Clark Lake, South Dakota, and Lake of the Woods, Minnesota. The average total lengths are definitely greater than those of Lake Winnebago, Wisconsin, sauger and in another study performed in the upper Mississippi River.

The total weights of sauger in Pools 3 and 4 were generally heavier than those fish caught in regionally similar areas such as Lake Winnebago.

From all this data, it can be surmised that Pools 3 and 4 have favorable conditions for excellent growth in the sauger. The fish are not only surviving here, but are also prospering well.

Keywords: Fish, Age and growth, Pools 3 and 4, Sauger

FOSSUM, J. D. 1975. Age and growth, food habit analysis and movement patterns of walleyes Stizostedion vitreum vitreum (Mitchell) in pools Nos. 3 and 4 of the Upper Mississippi River. M. S. Thesis, St. Mary's College, Winona, MN. 144 p.

Abstract: Life history information was collected in pools 3 and 4 during 1972 through 1974 in conjugation with operation of Prairie Island Nuclear Generating Plant near Red Wing, Minnesota. It appeared that pools 3 and 4 were capable of supporting faster growth than other regional lakes due to the higher average lengths and weights of fish from there.

During the fall gizzard shad represented 89% of the food of walleyes. No preference was shown for substrate type in fish movement. There was some affinity for shorelines and some avoidance if a constant thermal discharge from the plant was present.

Keywords: Fish, Age and growth, Food habits, Movement, Life history, Minnesota, Walleye

FOSTER, J. E. 1977. Flowline Study, Mississippi and Illinois Rivers. Hydraulic Model Investigation. Army Engineer Waterways Experiment Station, Vicksburg, MS. 67 p.

Abstract: These tests were conducted to develop water surface profiles on the Mississippi and Illinois Rivers to assist the St. Louis District in updating rating curves, reestablishing design grades for authorized levee projects, and developing data for economic benefit and flood insurance studies. These profiles will also be used to ascertain which river flowline, the Mississippi and Illinois Rivers just upstream of St. Louis, Mo., are affected by backwater from the Missouri River and by each other to the extent that the maximum stage at a given point for a particualar flow frequency may be produced by the flows of this frequency on any of these three rivers.

Keywords: Illinois River, Missouri River, Dam, Flow, Dike, Flood, Backwater, Closing structures, Models, Navigation

FRANCO, J. J. 1972. Shoaling conditions, St. Louis Harbor, Mississippi River. Army Engineer Waterways Exp. Station, Vicksburg, MS. 56 p.

Abstract: This phase of the model investigation of St. Louis Harbor was concerned with shoaling along the city front and at the lower entrance to the Chain of Rocks Canal. During unusually low river stages, less-than-project depths had been occurring at docks and terminals along the city front. Difficulties encountered during these low-flow periods led to the authorization of studies and investigations to determine the advisability of providing improved, commercial harbor facilities at and in the vicinity of St. Louis, Missouri. The purposes of the model study were to determine the causes of the shoaling in the harbor and docking areas and to develop plans that could be used to eliminate or reduce shoaling in these areas and in the lower entrance to the Chain of Rocks Canal. The model used in the investigation was of the movable-bed type, constructed to scales of 1:250 horizontal and 1:100 vertical and reproducing the reach of the Mississippi River and adjacent overbank areas between miles 191.0 and 169.9.

Keywords: Missouri, Chain-O-Rocks Canal, Dike

FRANCO, J. J. and J. E. GLOVER. 1965. Model Study of Bessie Cutoff, Mississippi River. Hydraulic Model Investigation. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Abstract: The model investigation of Bessie Cutoff, considered for construction on the Mississippi River, was concerned with obtaining information and data on the probable effects of the cutoff on channel development, channel stabilization, navigation, and flood control and to demonstrate the conditions expected to officials of the U. S. Army Corps of Engineers and local and navigation interests. The cutoff was proposed for construction across Slough Landing Neck about 60 miles below Cairo, Illinois. It would be about 5 miles long and would shorten the river by about 21 miles. A distorted, fixed-bed model, reproducing about 79 miles of the Mississippi River to scales of 1:500 horizontally and 1:100 vertically, was used for the investigation. The study also indicated the general effects of the cutoff on channel development and stabilization, the effects of the floodfree roadway connecting the severed area with the mainland, and the movement of sediment at the head of the cutoff during the initial development.

Keywords: Channel maintenance, Flood, Navigation, Canalization, Sediment, Models, Slough

FRANCO, J. J. and C. D. McKELLAR, JR. 1973. Channel Conditions, Devil's Island Reach, Mississippi River, Missouri and Illinois. Hydraulic Model Investigation. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 39 p.

Abstract: The Devil's Island Reach of the Mississippi River is located about 5 miles upstream of Cape Girardeau, Missouri, between miles 55.0 and 68.0. A movable-bed model with scale ratios of 1:400 horizontal and 1:100 vertical, reproducing approximately 13.0 miles of the Mississippi River, was used to develop a channel of project dimensions through the reach. Results of the investigation indicated that: Contracting the channel in this reach to a control width of 1500 ft. should generally provide adequate channel depths and alignment, except that special treatments might be required in crossings depending on the channel alignment and degree of sinousity provided in the improvement plan. The control width can be reduced to less than 1500 ft. to improve the depth and alignment of the channel over crossings with dikes of lower elevation than those used for the 1500-ft. contraction. The cost of dike construction can be reduced by use of the stepped-down construction in the design of dike systems.

Keywords: Missouri, Illinois, Channelization, Dike, Navigation, Ecology

FRANK, A. D. 1930. The development of the federal program of flood control on the Mississippi River. Hydraulic Engineering. 1930:58.

Abstract: This volume attempts to trace the development of the ever increasing program of the federal government. Special attention has been given to the forces that have aided or hindered the growth of such a colossal system of internal improvement.

Many theories of control have been advanced and considered. Numerous bitter controversies have occurred both among hydraulic engineers and among laymen concerning the various methods of flood control. This volume has neither attempted to solve technical engineering problems nor to settle controversies. It has only stated the outstanding ones as they have affected the development of the program of the Federal government.

Keywords: Development, Flood, Flooding

FRASCO, J. F. 1969. A method for the determination of net primary production and growth rate of Melosira (sp.) in the Mississippi River. B. A. Thesis, St. Mary's College, Winona, MN. 42 p.

Abstract: The construction and use of the phytoplankton samples for the lotic habitat was applied to samples for the determination of the net primary productivity and growth rate of Melosira (sp.). The membrane-filter technique was used for microscopic analysis of the diatom population. The sampler is of unique design and is shown to be an efficient means for the collection of phytoplankton that are emergent from bottom sediments.

Keywords: Primary production, Age and growth, Methods

FREMLING, C. R. 1955. The small mammal population of an island in the Mississippi River. M.S. Thesis, State Teachers College, St. Cloud, MN. 14 p.

Abstract: This was an attempt to determine population size of all species of small mammals on a 1.4 acre island in

the Mississippi River at St. Cloud, Minnesota. Four species of mammals were found from September 27, 1954 to November 7, 1954. A total of 36 specimens for 1800 trap nights. The river was thought to be an isolating mechanism. Cinereous shrew population was more trap susceptible than either of the two mouse populations.

Keywords: Mammals, Minnesota

FREMLING, C. R. 1959. Biology and possible control of economically important trichoptera and ephemeroptera of the Upper Mississippi River. Ph.D. Thesis, Iowa State University, Ames, IA. 205 p.

Abstract: This study discussed the nuisance and health problems caused by caddisflies and mayflies in Mississippi River cities.

Keywords: Upper Mississippi River, Invertebrates, Habitat management, Pesticides, Ecology, Distribution, Mayflies, Caddisflies

FREMLING, C. R. 1960a. Biology and possible control of nuisance caddisflies of the Upper Mississippi River. Iowa State Univ. Bull. 483: 855-879.

Abstract: The principal nuisance species of caddisflies at Keokuk, Iowa, are Hydropsyche orris Ross, Cheumatopsyche campyla Ross and Potamyia flava (Hagen), all members of the family Hydropsychidae (Order Trichoptera). The larvae of these species require considerable water current so that food may be carried into the nets which they construct upon submerged rocks and other silt-free structures. Keokuk lies along the tailwaters of the largest dam on the Upper Mississippi River, and the current and subsequent lack of silting create a large area which is favorable for hydropsychid larval habitation. Consequently, Keokuk is host to more caddisflies than the other river cities.

H. orris larvae build rigid catching nets and are most abundant in the fastest currents. C. campyla larvae construct loose, voluminous nets and are most abundant in the tailwaters and other areas where the current is moderated. P. flava larvae also build loose nets, but they are found most frequently in the rock and sand areas of the main channel of the river. Hydropsychid larvae are capable of populating areas by drifting with water currents.

Oviposting females of the three species were collected beneath the surface of the water with an underwater light trap. P. flava females were collected as deep as 20 feet and H. orris and C. campyla as deep as 12 feet. Females may re-enter the water several times, and emergence traps capture many more females than males. Experiments with a vertically floating pole indicated that oviposition was most concentrated at a depth of 3 to 4 feet. C. campyla and P. flava oviposition was observed in the laboratory, where adult females were seen to remain submerged for several hours.

An analysis of the numbers of caddisflies which were captured nightly at a downtown cafe window indicated that H. orris, C. campyla, and P. flava are bivoltine species, reaching peaks of abundance in early and late summer. Size-frequency distributions indicated that H. orris larvae collected from navigation buoys also indicated that H. orris completes two generations per year. C. campyla adults were reared from eggs in 51 days in the laboratory.

A blacklight trap was developed and may serve as a caddisfly abatement device at Keokuk. Insecticide space sprays applied to H. orris swarming areas hold promise, as do residual sprays applied to riverside foliage where the caddisflies rest during the day. H. orris caddisflies were shown to be vulnerable to four organic phosphorous insecticides. Of these, malathion is the most lethal. Granular larvicides applied to the tailwaters may control local larval populations temporarily. Low solubility of the granular formulation may prevent injury to fish. A loss of caddisfly larvae in the tailwaters should affect the fish very little since fish scarcely utilize the hydropsychid caddisfly larvae in this area.

Keywords: Upper Mississippi River, Invertebrates, Life history, Habitat management, Caddisflies, Mayflies

FREMLING, C. R. 1960b. Biology of a large mayfly, Hexagenia bilineata (Say), of the Upper Mississippi River. Iowa State University Res. Bull. 482: 841-852.

Abstract: Hexagenia bilineata (Say) and Hexagenia limbata (Serville) create nuisance problems by their sheer numbers in many cities along the Mississippi River. They also constitute a navigation hazard and may cause allergies.

H. bilineata is generally more abundant than H. limbata on the Upper Mississippi River, but H. limbata becomes increasingly abundant northward. The absence of inter-

mediate-sized nymphs in late summer indicates that H. bilineata completes a generation in 1 year in the Keokuk area. H. bilineata nymphs live in burrows in the river bottom and are most abundant in impounded areas where there is little current and where the river bottom is silty. Keokuk is less bothered by Hexagenia spp. than are other river cities because it lies only partially along a silted, impounded area. Other cities which lie entirely along silted areas, such as Fort Madison, Iowa, receive greater quantities of adult Hexagenia spp. Detailed observations were made of H. bilineata mating flights and the emergence of the subimago from its nymphal exuvia. An analysis of 150 observations of H. bilineata emergences on the Upper Mississippi River indicated that waves of emergence occur at intervals of about 6-11 days, with the maximum emergence occurring in mid-July. A single wave of emergence usually occurred almost simultaneously throughout the river segment. During the maximum wave, 30 observations were made during a 3-night period over a 440-mile expanse of river.

H. bilineata nymphs, subimagoes and imagoes were heavily parasitized by metacerearіae which were thought to be those of Megalogonia iclaluri and Crepidosotomum cooperi.

Hexagenia nymphs, which occur predominatly in shallow, slow-water areas, may be vulnerable to wet table powder of granular insecticides. The nymphs are a prime food of fish, however, and such control measures may adversely affect fish populations. Modifications in lighting may alleviate the mayfly problem to some extent.

Keywords: Invertebrates, Life history, Upper Mississippi River, Mayflies

FREMLING, C. R. 1964a. Rhythmic Hexagenia mayfly emergences and the environmental factors which influence them. Verh. Internat. Verein. Limnol. 15: 912-916.

Abstract: Mass emergences of mayflies (Hexagenia spp.) are familiar phenomena to people who live along the Mississippi River.

Keywords: Invertebrates, Life history, Mayfies

FREMLING, C. R. 1964b. Mayfly distribution indicates water quality on the Upper Mississippi River. Science 146(3648): 1164-1166.

Abstract: Mayflies have been eliminated by the polluted conditions of the river below the Twin Cities and St. Louis.

Keywords: Invertebrates, Water quality, Pollution, Distribution, Mayflies, Habitat alteration

FREMLING, C. R. 1967. Methods for mass-rearing Hexagenia mayflies (Ephemeroptera: Ephemeridae). Trans. Am. Fish. Soc. 96(4): 407-410.

Abstract: Study of the rhythmic emergence phenomenon for the past 8 years to determine the environmental factors which influence it. Presentation of the techniques developed to maintain large laboratory populations of Hexagenia mayflies.

Keywords: Invertebrates, Research, Propagation, Mayflies

FREMLING, C. R. 1968. Documentation of a mass emergence of Hexagenia mayflies from the Upper Mississippi River. Trans. Am. Fish. Soc. 97(3): 278-280.

Abstract: This report documents a mass Hexagenia mayfly emergence from the Upper Mississippi River, so that others may know of the magnitude of the phenomenon if Hexagenia populations are further reduced by pollution along the Upper Mississippi River. Man has already virtually eliminated Hexagenia mayflies from portions of Lake Erie, most of the Illinois River, and from segments of the Mississippi River.

Mayflies are primitive insects which belong to the order Ephemeroptera. The adults, which have vestigal mouth parts, usually mate and die within 30 hours after they emerge from the fresh water in which they have lived as aquatic nymphs. The genera Hexagenia, Pentagenia, and Ephemera are of special interest to vacationers, tow boat captains, motorists, and others who spend much time along the water's edge.

Keywords: Upper Mississippi River, Invertebrates, Life history, Mayflies

FREMLING, C. R. 1970a. Factors influencing the distribution of burrowing mayflies along the Mississippi River. Proceeding of First Interantional Conference on Ephemeroptera.

Abstract: Burrowing mayflies are abundant along much of the Mississippi River. Hoardes of imagoes and subimagoes often cause nuisance problems for river residents, motorists and towboat personnel. Yet, the three major burrowing species, Hexagenia bilineata (Say), Hexagenia limbata (Serville) and Pentagenia vittigera (Walsh), are not able to inhabit all sections of the river. Moreover, the distribution and relative abundance of the three species have apparently changed during the past 30 years. This report explains how various innate and environmental factors influence the distribution and relative abundance of the three species. It will also be demonstrated that mayfly distribution can be utilized to assess the wellbeing of a river which is so large that it cannot be monitored effectively or economically by standard methods.

Keywords: Invertebrates, Distribution, Mayflies, Habitat alteration

FREMLING, C. R. 1970b. Mayfly Distribution as a Water Quality Index. Published by EPA - Water Quality Office. 44 p.

Abstract: Three species of burrowing mayflies (Hexagenia bilineata, Hexagenia limbata, and Pentagenia vittigera) are sufficiently abundant to cause nuisance problems along portions of the Mississippi River. Mayfly distribution, as determined by collections made by ship captains and other cooperators over a 13-year period, has proven to be an excellent index of general water quality on a river which is so large that it cannot be monitored effectively or economically by standard methods. Pollutants have severely reduced the numbers of all three species for 30 miles below Minneapolis, Minnesota, and for over 300 miles below St. Louis, Missouri. Impoundment and enrichment of the Upper Mississippi River has temporarily increased the carrying capacity of the river for H. bilineata which now dominates areas formerly dominated by H. limbata. Methods have been developed to rear large numbers of Hexagenia nymphs in the laboratory. Bioassay tests utilizing artificial, burrow-containing substrates reveal that H. bilineata nymphs can survive anaerobic conditions for as long as 11 hours.

Keywords: Invertebrates, Water quality, Pollution, Toxicant, Minnesota, Impoundment, Research, Reproduction, Sediment, Heavy metals, Distribution, Mayflies

FREMLING, C. R. 1972. The impact of man on the ecology of the Mississippi River.

Abstract: This study discussed the various changes the Mississippi River has endured. Some of these are the deepening and widening of the main channel; the construction of 29 locks and dams in the Upper Mississippi River maintained by the U.S. Army Corps of Engineers; the use of the river by loggers, commercial and sport fishermen, sewage treatment plants, and power utility companies. There is also a discussion of the major fish and aquatic organisms that inhabit the Mississippi River.

Keywords: Dredging, Dike, Fishing, Development, Pollution, Fish, Wildlife, Ecology

FREMLING, C. R. 1973. Environmental synchronization of mass Hexagenia bilineata (Ephemeroptera) emergences from the Mississippi River. Verh. Internat. Verein. Limnol. 18(3): 1521-1526.

Abstract: The burrowing mayfly (Hexagenia bilineata Say) was reported to be abundant along the Upper Mississippi River as early as 1863 by Walsh and 1890 by Garman. Their abundance, however, has apparently been increased by the construction of 27 navigation dams along the Upper Mississippi River between Minneapolis, Minnesota, and St. Louis, Missouri. Most of the dams were constructed during the 1930's. The silted impoundments afford excellent H. bilineata habitat and the insects often cause sever nuisance porblems in river cities.

Keywords: Invertebrates, Ecology, Physiology, Climatology

FREMLING, C. R. 1975. Acute toxicity of the lampricide 3-Trifluoromethyl-4-nitrophenol (TFM) to nymphs of mayflies (Hexagenia sp.). U.S. Dept. Int., Fish and Wildlife Service.

Abstract: "A recycling test apparatus and burrow-containing artificial substrates were used to determine the toxicity of lampricide 3-Trifluourmethyl-4-nitrophenol (TFM) against Hexagenia mayfly nymphs. Toxicity was relatively independent of temperature, but was greater in soft water than were 4.0 at pH 6.5 and 270.0 at pH 9.5."

Keywords: Invertebrates, Toxicant, Pesticides, Mayflies

FREMLING, C. R. 1977. Mississippi River - 1999. A paper presented at the annual meeting of Upper Mississippi River Research Consortium, June 10, 1977. Winona St. University. 5 p.

Abstract: In twenty years, it is estimated that at least half of original water surface of backwaters will be lost. Sedimentation cannot be reversed, just slowed down. Doom was predicted for Lake Onalaska. A productive lake and important to canvasback ducks, economically and physically impossible to restore lake. Different types of sediment present and their effect in the river was discussed. Future construction and expansion of various highways will effect the river. Construction effects of new generating plants was also discussed.

Keywords: Accretion, Sediment, Urbanization, Habitat alteration, Lake Onalaska

FREMLING, C. R., D. V. GRAY and D. N. NIELSEN. 1973a. Final report environmental impact assessment study, Pool 4, of the northern section of the Upper Mississippi River. N. Star Res. Inst., Minneapolis, Minn.

Abstract: The purpose of the environmental impact study is to assess the impacts, both positive and negative, of the Corps' activities on the Northern Section. These activities are defined as operations and maintenance activities and mainly include operations of facilities (locks and dams) and maintenance of navigation channel (dredging). Actually, the impacts on the environment of the earliest operations are also being sought, but most of the information will concern those of the present navigation system.

Keywords: Pool 4

FREMLING, C. R., D. V. GRAY and D. N. NIELSEN. 1973b. Phase II report. Environmental impact study of Pool 5 of the northern section of the Upper Mississippi River Valley. Prepared for USACE, St. Paul District.

Abstract: Recommendations as result of the study are as follows. Closure of inlets will decrease depositon and erosion rates in the Weaver-Belvidere area which will decrease dredging requirements. Decrease the flow velocity in Weaver Bottoms area which in turn will increase the flood discharge in main Mississippi River. Biologically it would be better if the side channels were filled, rip rap placed in Murphy's cut and a quater-mile sand spit was constructed into lower end of Weaver's Bottoms.

Keywords: Pool 5, Flow, Flood, Weaver Bottoms, Upper Mississippi River

FREMLING, C. R., D. GRAY and D. N. NIELSEN. 1973c. Phase III. Pool 5 northern section of Upper Mississippi River Valley. Winona State College, Winona, MN. 298 p.

Abstract: The report includes an analysis of natural and socio-economic systems. The natural systems include terrestrial and aquatic plant and animal life as well as the nature of the land and quality of the water. Socioeconomic systems include industrial activities, such as income and employment generated by barge traffic or activities in operating the locks and dams and commercial fishing; recreational activities, such as fishing, boating, or hunting that are affected by Corps operations; and cultural considerations, which include archaeological and historical sites.

Keywords: Pool 5, Flow, Flood, Upper Mississippi River

FREMLING, C. R., D. V. GRAY and D. N. NIELSEN. 1973d. Final report: environmental impact assessment study, Pool 6, of the northern section of the Upper Mississippi River. N. Star Res. Inst., Minneapolis, MN.

Abstract: The present report deals only with Pool 6 on the Upper Mississippi River, described in detail.

The overall objectives of this report are to identify and provide an assessment of the impacts of the Corps of Engineers activities related to Pool 6.

Keywords: Pool 6

FREMLING, C. R., D. N. NIELSEN, D. R. MC CONVILLE and R. N. VOSE. 1976. Aquatic Plants IN: The Weaver Bottoms: a field model for the rehabilitation of backwater areas of the Upper Mississippi River by modification of standard channel maintenance practices. Final report to the U.S. Army Corps of Engineers, St. Paul District. Contracts DACW37-75-C-0193 and DACW37-75-C-0194. 52 p.

Abstract: Investigate deterioration of backwaters of Upper Mississippi River. Major waterfowl and hunting areas. Degradation phenomenon not limited to Weaver Bottoms. Determine causative factors, recommend specific rehabilitation procedure. Ascertain similarities between

Weaver area and Upper Mississippi River. Surveys conducted to identify similar areas in Mississippi River backwater system from St. Paul to Savanna, Illinois. Small flood plain. Submerged plants and ducks, waterfowl.

Keywords: Geology, Hydrology, Sediment, Wildlife, Weaver Bottoms

FREMLING, C. R. and T. W. SCHULTZ. 1977. A lake Winona Compendium.

Abstract: Lake Winona was highly eutrophic from dumping of 26 miles of storm sewage. In 1965 there was a severe winter kill. Proposed an electric weir and 3 large aerating units to be installed with a rotenone operation. This rotenone operation produced 733 pounds of fish per acre. It was restocked with bluegills, bass, pike, walleye, etc. Pondweed, a predictable problem, was recommended to be cut and harvested.

Keywords: Minnesota, Fish, Pollution, Habitat alteration

FREY, D. G. 1966. Limnology of North America. University of Wisconsin Press. Madison, WI.

Abstract: This volume attempts to summarize the development and current status of limnology in North America. The area of North America covered is divided into geographical regions and discussed in separate chapters.

Keywords: Limnology

FRISON, T. H. 1935. The Stoneflies, or Plecoptera, of Illinois. Ill. Nat. Hist. Surv. 20(4): 1-471.

Abstract: Summary of stonefly studies which have been more or less continuous since 1926. Discussion of the status of the group, structure, biology of the order (distribution-habitat preferences-seasonal adjustments-habits of adults and nymphs), collecting, rearing and preserving stoneflies. Includes a catalog of species, including classification, description, habits and records of Illinois stoneflies.

Keywords: Distribution, Invertebrates, Stoneflies, Life history

FRITZ, A. W. 1964. The Buffaloes of Illinois. Ill. Dept. Cons. Div. of Fisheries, Fish Mgt. Mimeo No. 29.

Abstract: In Illinois waters, there are three species of buffalo fishes: namely, the bigmouth buffalo, the smallmouth buffalo, and the black buffalo. These fishes are members of the sucker family; which also included the redhorses, white carp, and various other suckers such as the white sucker. The buffaloes are inhabitants of large waters, like the Illinois and Mississippi River and their adjoining backwater lakes.

Buffaloes are very important commercial fishes ranking only second to carp.

The foods of the buffaloes consists chiefly of microscopic animals which are strained from the water.

Keywords: Illinois River, Fish, Commercial fishing, Food habits, Spawning, Taxonomy

FRITZ, A. W. and W. C. STARRETT. 1957. The crappie story in Illinois. Outdoors in Illinois, Ill. Dept. Cons., 4(2): 11-14.

Abstract: In Illinois waters of the Mississippi River, and in the Illinois River it has been lawful since 1955 to take crappies with legal commercial fishing devices for the purpose of sale. The open season for commercial crappie fishing in Illinois is from September 15 through March 31. Crappies taken commercially must not be less than 8 inches in total length undressed and 6 inches dressed. Crappies taken by anglers are subject to no restrictions. We have no reason to believe at this time that commercial fishing and liberalized pole-and-line fishing for crappies have had any effect upon the fishery.

Keywords: Fish, Illinois, Crappie

FUGINA, F. J. 1945. Lore and lure of the Upper Mississippi. Winona, MN. Privately published.

Abstract: The author, an old-time river captain, describes with personal accounts all aspects of river activity. From Indians paddling the river in search of game, through packet boats, towboats, showboats, raftboats, excursion and pleasure boats, and finally steel boats and barges, the author has experienced it all. He has also seen the three-foot channel give way finally to the nine-foot channel.

Keywords: History

FULLER, S. 1978. Fresh H_2O mussels of the Upper Mississippi River: Observations at selected sites within the 9-foot Channel Navigation Project on behalf of the U.S. Army Corps of Engineers.

Abstract: The freshwater mussels population of the Mississippi River in the region of the nine-foot channel was surveyed.

Keywords: Mussels, Nine-foot channel

FUNK, J. L. 1963-1969. Abstracts of fishery research reports No. 1 (1962) - 7 (1968). Mo. Cons. Comm., Div. Fisheries.

Abstract: A series of articles, separated by river or lake, which describe fish populations and fish creel census. Life histories, breeding, distribution, and behavior of the common fish are discussed.

Keywords: Fish, Missouri, Research

FUNK, J. L. and R. S. CAMPBELL. 1953. The population of larger fishes in Black River, Missouri. Univ. Mo. Stud. 26(2): 69-82.

Abstract: Thirty-four species of fish represented by 2,579 individuals weighing 722 pounds were collected from three areas on the Black River in 1947 and 1948. The gar, mooneye, gizzard shad, hog sucker, redhorses, carp, channel catfish, yellow bullhead, flathead catfish, yellow walleye, smallmouth bass, largemouth bass, green sunfish, longear sunfish, rock bass, and bowfin were of sufficient importance to warrant special attention. The collections are analyzed by river section and by fishing methods. The limitations of the methods used and the effects of gear selectivity are discussed. Only fish weighing one-half ounce or more were considered in this study.

Keywords: Fish, Black River, Missouri, Population

GAKSTATTER, J. H. 1971. Report of the Quad-Cities nuclear plant hearing regarding effects of thermal wastes on the Mississippi River. Report submitted to the Iowa Water Pollution Control Commission by the Iowa State Hygienic Laboratory, 26 p.

Abstract: The public hearing held by the Illinois Pollution Control Board convened on Monday, May 24 and adjourned on Wednesday, June 9. Members of the Illinois Pollution Control Board were not present during the hearing which was presided over by an independent hearing officer. Illinois' case was handled by attorneys from the Illinois Attorney General's Office.

It was the general consensus of opinion that the interim plan and diffuser pipe system currently proposed by Commonwealth Edison involved many potential adverse effects on the fisheries of Pool 14 and below. It was also agreed that all of these risks would be eliminated by the use of a closed cycle cooling system at the Quad-Cities Plant.

Keywords: Thermal effluent, Nuclear power, Limnology, Ecology

GAKSTATTER, J. H. and R. L. MORRIS. 1969a. Mississippi River water quality survey report, Clinton, Iowa area. State Hygienic Laboratory Report, University of Iowa.

Abstract: The purpose of this study was to determine whether or not the bottom fauna was being detrimentally affected by waste discharges and if so, to what extent.

Keywords: Water quality, Iowa

GAKSTATTER, J. H. and R. L. MORRIS. 1969b. Mississippi River water quality survey report, Fort Madison, Iowa area. State Hygienic Laboratory Report. University of Iowa.

Abstract: The purpose of this study was to delineate chemical, bacteriological and biological conditions of the Mississippi River from February through August 1969.

Keywords: Water quality, Iowa

GAKSTATTER, J. H. and R. L. MORRIS. 1969c. Mississipi River water quality survey report, Muscatine, Iowa area. State Hygienic Laboratory Report. University of Iowa.

Abstract: The purpose of the study was to delineate chemical, bacteriological, and biological conditions of the Mississippi River from February through August 1969.

Keywords: Water quality, Iowa

GAKSTATTER, J. H. and R. L. MORRIS. 1969d. Mississippi River water quality survey report, Davenport, Iowa area. State Hygienic Laboratory Report 70-7. University of Iowa.

Abstract: Chemical, bacteriological, and biological samples were collected upstream and downstream from the major waste discharges.

Keywords: Water quality, Iowa

GAKSTATTER, J. H. and R. L. MORRIS. 1969e. Mississippi River water quality survey report, Keokuk, Iowa area. State Hygienic Laboratory Report 70-8. University of Iowa.

Abstract: This report includes studies on the chemistry, bacteriology and biology of the river in the Keokuk area during the week beginning September 8, 1969.

Keywords: Water quality, Iowa

GAKSTATTER, J. H. and R. L. MORRIS. 1969f. Mississippi River water quality survey report, Burlington, Iowa area. State Hygienic Laboratory Report 70-17. University of Iowa.

Abstract: The following report covers water quality investigations conducted in the Burlington area during the period of October 8 to October 16, 1969. During this period, water sampling for chemical and bacteriological quality was done on October 8 and 9 and the biological samples were taken from October 14-16. Exact river flows for the period of chemical and bacteriological sampling have not been obtained yet, however, observations indicated that they were considerably lower than during the February survey.

Keywords: Water quality, Iowa

GAKSTATTER, J. H. and R. L. MORRIS. 1970a. Mississippi River water quality survey report at Burlington, Iowa. State Hygienic Laboratory Report 70-41. University of Iowa.

Abstract: This report, which covers data collected in early April of this year, both supplements and substantiates data and conclusions which resulted from the October 1969 study.

The effects of Burlington wastes on the chemistry of the Mississippi River during this study were very small and were limited to the narrow strip of water along the Iowa bank for approximately 0.5 mile below the Burlington outfall.

The bacteriology of the river with respect to both total and fecal coliforms was essentially unaffected by the Burlington discharges as a result of the chlorination of incoming raw wastes by the Burlington Sewage Treatment Plant.

Biologically there was some degradation localized below the point of storm sewer discharges (mile 403.9-404) however by mile 403.3 recovery was evident. Below the treatment plant outfall (mile 403.2) there was some biological degradation in the soft substrate resulting from the long term accumulation of organic debris. No areas were degraded to the degree where only pollution tolerant organisms were present. Stonefly nymphs, which require high quality water, were collected at three stations in the first 0.15-0.6 miles below the outfall. The total observed biological effect was limited to the area immediately along the Iowa bank and represented an extremely small percentage of the total cross section of the river in that area.

Keywords: Water quality, Iowa

GAKSTATTER, J. H. and R. L. MORRIS. 1970b. Limnology of the Iowa reach of the Mississippi River. Health Laboratory Service 8: 83-88. Iowa State Hygienic Laboratory Report No. 71-21.

Abstract: Purpose of the study was to determine whether waste discharges were causing a violation of chemical water quality standards, contaminating downstream areas or harming the biological community.

Keywords: Pool 14, Discharge, Limnology, Water quality, Iowa

GAKSTATTER, J. H. and R. L. MORRIS. 1971. Water quality survey of the Mississippi River near Dubuque, Iowa. State Hygienic Laboratory Report 72-18. University of Iowa.

Abstract: Results of this survey indicated that the then expanding water treatment plant for Dubuque should undergo an engineering survey to indicate whether it was performing up to expectations (64% BOD removal). Inasmuch as a 90% BOD removal was expected for the future water treatment problems which were presently manifest should be immediately solved.

Keywords: Water quality, Iowa

GALBREATH, E. C. 1974. A cranium of symbos-cavifrons mammalia from the Mississippi River between southern Illinois and Missouri USA. Trans. Ill. St. Acad. Sci. 67(4): 393-396.

Abstract: Description and discussion of the cranium and the endocranial cast are presented with speculation that the remains came from Wisconsian deposits in Illinois. The cranial cast has a distinctive shape, possibly associated with structural support for the horns, that may be of taxonomic value or of use in identifying male and female individuals.

Keywords: Wildlife, Mammals, Distribution, Survey, Taxonomy, Rare species, Illinois, Missouri

GALE, W. F. 1969. Bottom fauna of Pool 19, Mississippi River with emphasis on the life history of the fingernail clam, Sphaerium transversum. Ph.D. Thesis. Iowa State University, Ames, IA. 241 p.

Abstract: This study was begun in 1966 as the first of a two phase investigation to determine dredging effects on fauna of Pool 19 of the Mississippi River. Monthly, from June to December, 1967, four 7.62 cm core samples were taken at seven stations.

Keywords: Fingernail clam, Benthos, Pool 19, Life history, Clams

GALE, W. F. 1972. Seasonal variability in calyculism in Sphaerium transversum (Say). Nautilus 86(1): 20-22.

Abstract: The neipionic shell of the freshwater bivalve, Sphaerium transversum, may be separated from the older part of the shell by a sulcus, thus forming a bulging "cap" or calyculus at the umbo. Populations sampled from a stream in Iowa showed varying percentages of specimens

being calyculate or noncalyculate. Growth experiments in a field laboratory indicated that arrested growth caused the formation of a calyculus, thus suggesting that this character is of questionable taxonomic importance.

Keywords: Clams

GALE, W. F. 1973a. Substrate preference of the fingernail clam, Sphaerium striatinum (Lamarck). The Southwest Naturalist. 18(1):31-37.

Abstract: In a laboratory substrate experiment large fingernail clams (Sphaerium striatinum) showed no clear preference for mud, sand or sandy mud. Small clams of the same species exhibited a two-fold selection for mud over sand and sandy mud (significant at 0.05 level). S. striatinum usually occurs in sandy substrates in Pennington Cree, Johnston County, Oklahoma and substrate selection does not appear to be a major factor in determining its distribution.

Keywords: Clams, Benthos, Fingernail clam, Research, Habitat

GALE, W. F. 1973b. Predation and parasitism as factors affecting Sphaerium transversum (Say) populations in Pool 19, Mississippi River. Research in Population Ecology 14: 169-187.

Abstract: Of the numerous macroinvertebrates inhabiting Pool 19 of the Mississippi River probably none are more important or less known than the fingernail clam, Sphaerium transversum. S. transversum's relatively small size, wide distribution and high degree of vulnerability, coupled with great reproductive potential make it ideal prey for a variety of fishes, leeches and waterfowl.

An opportunity to investigate the life history of S. transversum presented itself during a survey of the bottom fauna of Pool 19 from 1966-68. Observations on population changes and factors contributing to those changes are discussed here.

Keywords: Clams, Benthos, Pool 19, Predation, Parasites, Fingernail clam

GALE, W. F. 1975. Bottom fauna of a segment of Pool 19 Mississippi

River near Fort Madison, Iowa, USA. 1967-68. Iowa State J. Res. 49: 357-372.

Abstract: This study was begun in 1966 as the first of a two phase investigation to determine dredging effects on fauna of Pool 19 of the Mississippi River. Monthly, from June to December 1967, four 7.62 cm core samples were taken at seven stations. The molluscan fauna included 13 species of gastropods, 7 species of sphaeriids and 20 species of unionids.

Keywords: Benthos, Fingernail clam, Invertebrates, Fish, Ducks, Vegetation, Biomass, Dredging, Pool 19, Iowa, Clams

GALE, W. F. 1976. Vertical distribution and burrowing behavior of the fingernail clam, Sphaerium transversum. Malacologia 15(2): 401-409.

Abstract: Small fingernail clams, Sphaerium transversum (Say), occurred as deep as 16 cm in the substrate in Pool 19 of the Mississippi River; clams over 3.0 mm long occurred only in the upper 2.6 cm of substrate. Penetration was deepest in soft clayey silt and shallowest in coarse sand. At Lake Texoma, Oklahoma, newborn S. transversum were placed in plastic tubes containing a substrate and allowed to burrow under various experimental conditions.

In these experiments, newborn clams burrowed to a maximum depth of 24 cm in sandy-mud (85% sand) and to 11 cm in mud. Some newborn clams burrowed 6 cm deep in 12 hours but burrowing continued for 24 to 48 hours. Clams reburrowed after being brought to the substrate surface. Clean density seemed to have no effect on depth of clam burrowing. Clams born in a pan of lake water burrowed deeper than clams born in the substrate.

Newborn clams that burrow may enter a "resting-state." Maintenance of a segment of the clam population deep in the substrate may prevent excessive losses during periods of heavy predation, disease or unfavorable water conditions.

Keywords: Clams, Distribution, Benthos, Fingernail clam, Behavior

GALE, W. F. 1977. Growth of the fingernail clam Sphaerium transversum in field and laboratory experiments. Nautilus 91(1): 8-12.

Abstract: Field and laboratory experiments on Pool 19 of the Mississippi River in summer and fall of 1967 revealed that S. transversum can complete its life cycle in about a month or less. In laboratory experiments, many newborn clams entered a resting state and did not grow for 33 days after they were born; later, some grew large. Medium-sized clams grew slowly but gave birth to young that often grew faster and larger than their parents. In field experiments, clams that were moved from an open-river site (where the clam population was high) to a retainer in a cove (where the population was low) grew faster and became larger than those remaining at the collection site; they also grew larger than clams in laboratory experiments.

Keywords: Fingernail clam, Production, Research, Survey, Clams

GALE, W. F. and R. L. LOWE. 1971. Phytoplankton ingestion by fingernail clam (Sphaerium transverum) in Pool 19, Mississippi River. Ecology. 52: 507-513.

Abstract: Fingernail clam derived most of its food from diatoms and green algae. Phytoplankton communities in Pool 19 were documented. Cyclotella, Melosira, Stephanodiscus and Scenedesmus were the most prevalent genera in Pool 19.

Keywords: Benthos, Fingernail clam, Phytoplankton, Food habits, Pool 19, Temperature, Clams

GALLAGHER, B. J. 1974. Energy producton and thermal effects. Limnetics Inc. Report.

Abstract: Proceedings of a symposium on "Energy Production and Thermal Effects" held in Oak Brook, Illinois, on September 10-11, 1973, are reported. Subjects include: Federal Research on Thermal Effects; AEC programs and approaches to environmental thermal research; thermal pollution influence on the aquatic ecosystem; social reponsibility in thermal pollution; ecological studies on a southeastern reservoir receiving effluent from a nuclear reactor; zooplankton artificial cooling lakes as unique aquatic ecoystems; a case history of an Illinois cooling lake; a comparison of the thermal effects in the Mississippi River from two different cooling water discharge techniques; facing of the challenge of the energy dilemma; matching of heating water discharges to environmental assimilative capacity; submerged diffusers for cooling water discharges; large-

scale water cooling by floating spray devices; dry cooling towers; the Atlantic Generating Station; power plant efficiency in the future; thermal aquaculture; thermal discharge abatement; beneficial uses of reject heat; and future uses of mathematical models to predict ecological effects from thermal discharges. (Numerous diagrams, graphs, photos, references, tables).

Keywords: Thermal effluent, Models, Pollution, Nuclear power, Ecology, Zooplankton

GALSTSOFF, P. S. 1924. Limnological observations in the Upper Mississippi River, 1921. Bull. U.S. Bur. Fish. 39: 347-438.

Abstract: This paper deals with results of the hydrobiological investigation of the section of the Upper Mississippi River between Hastings, Minnesota and Alexandria, Missouri.

Keywords: River lake, Habitat, Production, Population, Limnology

GAMBRELL, R. P., R. A. KHALID, M. G. VERIOO, and W. H. PATRICK, JR. 1977. Transformations of Heavy Metals and Plant Nutrients in Dredged Sediments as Affected by Oxidation Reduction Potential and pH. Volume II. Materials and Methods/Results and Discussion. Louisiana State University. Baton Rouge Agricultural Experiment Station. 333 p.

Abstract: A laboratory study was conducted to determine the effects of pH and oxidation-reduction conditions on the distribution of mercury, lead, cadmium, zinc, copper, manganese, iron, phosphorus, and ammonium-nitrogen among selected chemical forms in sediment-water systems from four (Gulf Coastal) sites. This study was designed to determine how changes in these physiochemical parameters, such as may occur during dredging and dredged material disposal, might affect the chemical availability of these nutrients and toxic substances and thus reflect possible changes in their bioavailability. Studies indicated the pH and redox potential influence the chemical form and distribution of the metals studies, although the response to changes in the physiochemical environment were frequently not the same for different metals. Results suggest that the pH and redox potential are important in regulating the chemical availability of a number of nutrients and potentially toxic trace

metals. The metal regulatory processes involved included precipitation with sulfide, absorption or coprecipitation with colloidal hydrous oxides, and complex formation with soluble and insoluble organics. In many cases, changes in acidity or oxidation-reduction conditions resulted in considerable transformations among potentially available forms.

Keywords: Dredging, Heavy metals, Sediment, Sedimentation, Aquatic plants, Water quality, Ecology, Research

GARING, D. and C. HARRISON. 1975. Railroads join environmental groups to fight plans for new river locks near Alton, Illinois. Wall Street J. 40 p.

Abstract: Railroads and environmentalists have joined forces to battle a U.S. Army Corps of Engineers proposal to replace a set of locks and a dam on the Mississippi River. An improved barge system would decrease railroad revenues and environmentalists are concerned about damage from construction and dredging.

Keywords: Illinois, Lock, Dam, Commerical boat traffic, Dike, Dredging

GARMAN, J. 1890. A preliminary report on the animals of the Mississippi bottoms near Quincy, Illinois in August 1888. Part I. Ill. Nat. Hist. Bull. 3: 123-184.

Abstract: The animals of the Mississippi bottoms are discussed as they relate to the different localities where they are found.

Keywords: Illinois, Mammals, Survey

GEBKEN, D. F. and K. J. WRIGHT. 1972. Walleye and Sauger spawning areas study, Pool 7, Mississippi River 1960-1970. Manage. Rept. No. 60. Wisc. Dept. Nat. Res., Bur. Fish Manage.

Abstract: On April 14, 1969, a small congregation of ripe walleye and sauger was located by electrofishing over a rock riprapped dike adjacent to Lock and Dam 6 on the Mississippi River. Egg sampling at the location of the congregation recovered walleye eggs but no sauger eggs. No spawning concentrations of walleye and sauger were located in 1970 and 1971.

Walleye in Pool 7 apparently spawn on similar substrates as those used by walleye in other waters. Spawning areas used by sauger were not located.

Length frequencies, age of maturity, and sex ratios of Pool 7 walleye and sauger have been compared to those from other pools of the Mississippi River and from waters other than the Mississippi River.

The possible correlation of walleye and sauger year class strengths with flood stages which occur during spawning is discussed. Integration of Corps of Engineers flood and erosion control measures with walleye and sauger management is evaluated.

Keywords: Fish, Pool 7, Spawning, Survey, Reproduction, Life history, Lock and Dam 8, Walleye, Sauger

GENGERKE, T. W. 1977. Exploitation, Harvest Potential and Basic Life History of Paddlefish in the Upper Mississippi River. 39th Midwest Fish and Wildlife Conference, December 1977 in Madison, Wisconsin.

Abstract: Investigations in the Upper Mississippi River were initiated to evaluate exploitation and harvest potential of paddlefish and to obtain information on basic life history necessary to formulate suitable management regulations. Over 2,250 paddlefish from various sources were examined during the first two years of study. Eleven hundred paddlefish were tagged and released in Pool 13. Most fish were captured by snagging in the tailwaters of Lock and Dam 12. Mean catch per effort was 1.55. Two hundred seventy-eight were tagged and released in other pools adjacent to Iowa. Tag return information indicated a significant portion of the total mortality is due to sport fishing. In addition, tag return information from commercial fish landings indicated that fish move throughout the pool with some inter-pool exchange. Four hundred twenty-five aged jaw samples included most year classes through age 18. Preliminary calculations of annual survival from age frequency distribution were 75% for male and 80% for female paddlefish. The study area included all pools of the Mississippi River bordering Iowa with special emphasis on Pool 13 near Bellevue, Iowa.

Keywords: Upper Mississippi River, Fish, Life history, Harvest, Pool 13, Lock and Dam 12, Iowa, River pond, Paddlefish

GENTILLE, J. M. 1968. A study of the phosphorous levels of the Mississippi River and adjoining streams in Pool 6. B.A. Thesis, St. Mary's College, Winona, MN. 38 p.

Abstract: The Mississippi River has a portion of its run along the border of western Wisconsin and southeastern Minnesota. Many small streams flow into the river between Lake Pepin and LaCrosse, Wisconsin. Some of these creeks, and the river itself, are starting to show signs of deterioration in quality as a result of receiving excessive amounts of nutrients. Among the chief offenders of these nutrients are the phosphates.

Keywords: Pool 6, Chemistry

GERHOLD, R. M. and L. M. MOORE. 1977. Thermal monitoring at Quad-Cities Station. NALCO Environmental Science, presented at UMRCC Meeting, June 1977.

Abstract: A paper which gives a brief history of the Quad-Cities Station, the purpose of thermal monitoring, and the purpose of this report which shows the results of temperature monitoring as a function of cooling mode. The methods of temperature monitoring are also discussed.

Keywords: Thermal effluent, Nuclear power, Limnology, Ecology, Habitat alteration

GILL, G. W. Undated. A comprehensive study of the freshwater oligochaete Tubifex tubifex. Research paper presented to Graduate Faculty, Winona State College. 84 p.

Abstract: The author has conducted studies on Tubifex to give physical characteristics which distinguish them from other Oligochaetes. The habitat is also described.

Keywords: Invertebrates, Benthos

GLAZIER, W., CAPT. 1888. Down the great river. Hubbard Brothers. Phil. 433 p.

Abstract: Views, descriptive and pictorial, of the cities, towns, villages and scenery on the banks of the river, as seen during a canoe voyage of over three thousand miles from its headwaters to the Gulf of Mexico.

Keywords: History

GLAZIER, W., CAPT. 1897. Headwaters of the Mississippi. Rand McNally and Co., Chicago. 527 p.

Abstract: This volume presents as far as possible, from all available sources, some idea which led to certain important discoveries in North America, together with sketches of the old and recent explorers.

Keywords: History

GOOCH, V. K. 1967. Identification of Hexagenia bilineata and H. limbata nymphs. Entomol. News 78(4):101-103.

Abstract: Discussed morphological differences used to separate these two types of nymphs. Differences in the tarsal claws, maximum length and length of caudal filaments and cerci are given.

Keywords: Taxonomy, Invertebrates, Benthos, Mayflies

GOODE, G. B. et al. 1884-1887. The fisheries and fishery industries of the United States. U.S. Comm. Fish and Fisheries, 5. Vols. I-VII.

Abstract: The investigation of the fisheries of the United States was divided into the following department: natural history of marine products, fishing grounds, fishermen, apparatus and methods of capture, and economy of fisheries.

Keywords: Fishing, History, Catch

GOULD, N. W. 1889. Fifty years on the Mississippi. St. Louis: Nixon-Jones Printing Co. 750 p.

Abstract: A history of navigation on the rivers of the Mississippi Valley which deals with the settlement of the country, the character and habits of the early navigators, modes of early transportation, the invention of steam and its application to navigation.

Keywords: History, Navigation

GRABER, R. R. 1973. Mississippi River heron census. Illinois Natural History Survey. Report to the Waterways Experiment Station. 4 pp.

Abstract: Part of a series of reports based on series of flights from St. Louis to Cairo to assess heron populations in this area.

Keywords: Waterfowl, Illinois

GRABER, R. R. 1974. Mississippi River heron census II. Illinois Natural History Survey. Report to the Waterways Experiment Station. 5 pp.

Abstract: A continuation report of studies conducted on heron populations near St. Louis and Cairo in 1974.

Keywords: Waterfowl, Illinois

GRABER, R. R. 1975. Mississippi River heron census III. Illinois Natural History Survey. Report to the U.S. Army Corps of Engineers, St. Louis District.

Abstract: The results obtained in 1975 of heron censuses conducted between St. Louis and Cairo.

Keywords: Waterfowl, Illinois

GRABER, R. R. 1976. Mississippi River heron census IV (With comments on the least tern). Report to the U.S. Army Corps of Engineers, St. Louis District. 4 pp.

Abstract: Part of series of waterfowl censuses conducted by flights over the Mississippi area from St. Louis to Cairo.

Keywords: Waterfowl, Illinois

GRABER, R. R. 1977. Mississippi River heron census V. Illinois Natural History Survey. Report to the U.S. Army Corps of Engineers, St. Louis District. 1 p.

Abstract: The results of a 1977 heron census conducted between St. Louis and Cairo is presented in a table.

Keywords: Waterfowl, Illinois.

GRAHAM, R. O. 1968. The relation between fecal coliform levels in the intestine of invertebrates and in the environment. B.A. Thesis, St. Mary's College, Winona, MN. 8 p.

Abstract: From previous studies it seemed possible that the bacterial flora of the intestine of cold-blooded animals could be fecal coliform free when in an uncontaminated environment. The only organisms examined were fishes and insects. This study was extended to scuds, snails, and caddisfly larvae.

The animals were collected from uncontaminated springs and macerated. The supernatant was then filtered through Millipore filters and incubated on a suitable medium. The condition of the cultures was specific for fecal coliform bacteria.

As a result of the study it was shown that these organisms contained no fecal coliform bacteria in their intestines when living in an uncontaminated environment.

Keywords: Bacteria, Invertebrates, Fish, Habitat alteration

GRANT, U. S. 1887. Notes on the Molluscan fauna of Minnesota. Ann. Rept. Geol. and Nat. Hist. Surv. Minn. 16:481-484.

Abstract: A brief discussion of the mollusks found in Minnesota with their distribution and life histories.

Keywords: Mollusks, Minnesota

GRAVES, E. 1976. Corps Director Predicts 'Dredging Renaissance'. World Dredging and Marine Construction. 12(10): 44-48.

Abstract: Landfill and fertilizer are two new uses for dredged material that should enhance the economic outlook for the dredging industry. The dredged material research program. Started in 1973, seeks information about environmental impacts, suitable alternatives to dredging, and the development of prototype tests. The same legislation also established a confined disposal plan for the Great Lakes.

Keywords: Dredging, Ecology

GREEN, W. P. 1910. Damming the Mississippi. Sci. Am. 102. (21 May 1910): p. 422.

Abstract: A huge dam is being built across the Mississippi just north of Keokuk. Stored electricity will amount to

200,000 electrical horsepower to be distributed throughout the Middle West. The dam will be 4,700 feet long, 37 feet above the water and a base of 43 feet of reinforced concrete. Excelled in mass only by the monster dam across the historic Nile River.

Keywords: Dam

GREENBANK, J. 1936. A comparison of the characteristics of various types of commercial fishing gear. UMRCC Invest. Rept. No. 38, 18 p.

Abstract: The main sources of information used in this report are recorded catches, by tackle, of commercial fishermen in their routine fishing operations and the catches of several types of gear fished experimentally as part of the river survey. The experimental fishing had, as part of its primary purpose, the obtainment of information on fishing characteristics and efficiency of certain types of tackle under various conditions.

Keywords: Commerical fishing, Fishing, Equipment

GREENBANK, J. 1945a. Notes on pool drawdown, winter 1944-45. UMRCC Invest. Rept. No. 1, 2 pp.

Abstract: Observations concerning mainly Pools 3 to 8, inclusive. Pools 3 to 6 were partially drawn, early in January, and thereafter were maintained at level, or rose slightly, until March 1. Pool 8 was drained completely, in a 2-day operation, early in January, and remained at draw-down stage until late February, when river flows started to fill it somewhat. The drop in level amounted to about 6 feet just above the dam, 2 1/2 to 3 feet at the control point (La Crosse), and 1 to 2 feet just below Dam 7. The gates were completely closed on March 11, and the pool filled rapidly, since the spring floods commenced soon thereafter. Pool 7 was held practically at level throughout the winter. Pool 9 was partially drained, in January, and thereafter was raised slowly.

Keywords: Hydrology, Drawdown, Pools 3-8

GREENBANK, J. 1945b. Notes on slat traps. UMRCC Invest. Rept. No. 2. 1 p.

Abstract: Commercial fishing with slat traps was extensively observed during the summer of 1944, at Lansing, Harpers

Ferry, Clayton, and Guttenberg. In all perhaps 40 or 50 crew-days of fishing were observed by this method, from late June until late August.

Keywords: Fishing, Commercial fishing, Iowa

GREENBANK, J. 1945c. Report for the upper division, Mississippi River Survey. In: 1st Ann. UMRCC Proc. pp. 17-25.

Abstract: Discussion of the construction of 215 dams in drainage ditches in 17 Wisconsin drainage districts. The dams were not successful in restoring the areas to their normal condition.

Keywords: Dam, Wisconsin

GREENBANK, J. 1945d. Preliminary report on creel census, summer of 1944 and winter of 1944-45. UMRCC Invest. Rept. No. 3, 9 p.

Abstract: For the summer fishing season of 1944, only Pools 7 and 8 (that is, the area near La Crosse) were included in the creel census. During most of the season Pool 8 was covered fairly throughly, the coverage on Pool 7 was comparatively incomplete. The summer census was performed in cooperation with the Badger State Sportsmen's Club of La Crosse, various boat livery operators, and certain sporting goods' stores. The majority of the questionnaire blanks were filled out by the creel census clerk specially employed by the Upper Mississippi River Survey.

Keywords: Survey, Creel census, Fish, Pools 7 and 8

GREENBANK, J. 1946a. Notes on pool drawdown, winter 1945-46. UMRCC Invest. Rept. No. 4, 4 p.

Abstract: Pools 3 to 6 were gradually, but rather heavily, drawn in the second and third weeks in December. Pool 8 was suddenly drawn on December 26-27, the total drop above the dam being over 3 feet, and at La Crosse (the control point) about 1 1/2 feet. Pool 7 was more gradually dropped, in the last week in December. An unprecedented heavy rain, occurring on January 5 & 6, combined with melted snow and run-in water, resulted in raising the pools to approximately pool stage, where they were maintained for the balance of the winter. Thus, the duration of lowered water levels, especially in Pools 7 and 8, was relatively short.

Keywords: Hydrology, Drawdown, Pools 3-8

GREENBANK, J. 1946b. Effects of midwinter drawdowns of the Upper Mississippi River on aquatic wildlife. UMRCC Invest. Rept. No. 5, 10 p.

Abstract: The U.S. Army Engineers have found it necessary, for four consecutive winters, to withdraw water from the Upper Mississippi storage pools between Minnesota and Wisconsin to provide water downstream for navigation. These drawdowns have brought serious criticism from people living along the river and have raised official protests from bordering states. Grave concern has been felt over the effects of drawdowns on fish and animal life of the river on which many people depend for recreation, food, and livelihood. Each year an attempt has been made by state and federal agencies to evaluate these effects, but the magnitude of the problem shifting environmental conditions within the river, and variable weather experienced in midwinter, have made difficult the gathering of definite and conclusive data.

Keywords: Upper Mississippi River, Wildlife, Hydrology, Habitat alteration, Drawdown

GREENBANK, J. 1946c. The fish population of Cassville Slough. UMRCC Invest. Rept. No. 6, 3 p.

Abstract: Cassville ("Twelve-Mile") Slough is the eastern side-channel of the Mississippi River which extends from above Guttenberg, Iowa to about 1 mile above Cassville, Wisconsin. At one time a main channel, it still, in part, makes up the state-line boundary between Iowa and Wisconsin. At the Engineers Dam #10, at Guttenberg, the slough is blocked by a concrete and earth dam and spillway. The slough, from that point to its mouth, is, in most seasons, relatively quiet water, ramified by various side slough, bayous, and backwater ponds and lakes. It is with this part of the slough that we are here concerned.

Keywords: Fish, Survey, Slough, Population

GREENBANK, J. 1946d. Lengths, weights, and conditions factors of sheepshead. UMRCC Invest. Rept. No. 8, 4 p.

Abstract: During the summers of 1944, 1945, and 1946, a number of sheepshead were weighed and measured at the Lansing fish market. These fishwere taken by commercial fishermen, in "buffalo" (hoop) nets, in Pool 9 in the vicinity of Lansing. All of the work was done in July and August with more of it in 1944 and a small amount in 1945 and 1946. The sample was taken from run of the catch lots and is only representative of the hoop net catch in the Lansing area.

Keywords: Fish, Survey, Population, Length-weight, Condition, Sheepshead

GREENBANK, J. 1947a. Field notes on river drawdown. UMRCC Invest. Rept. No. 10, 1 p.

Abstract: On October 1, 1947, the U.S. Engineers, at the request of the La Crosse Badger Sportsmen's Club, began drawing down the water in Pool 8, to facilitate repair work on the Good Island Road. By the morning of October 4, the water had dropped approximately two feet throughout Pool 8. This lower level remained until October 5, when, in the evening, refilling commenced.

Keywords: Hydrology, Habitat alteration, Drawdown, Pool 8

GREENBANK, J. 1947b. Catfish production, Mississippi River. UMRCC Invest. Rept. No. 12, 2 p.

Abstract: This summary of production of catfish in the Upper Mississippi Rvier, according to fishing methods, was presented at a joint meeting, La Crosse, Wisconsin, on November 5, 1947, between Wisconsin and Minnesota Conservation Department representatives. The summary was presented for consideration in connection with proposed regulations concerning catfish.

Keywords: Fish, Production, Catfish

GREENBANK, J. 1947c. Movement of fish under ice. UMRCC Invest. Rept. No. 13, 13 p.

Abstract: The investigations of winter pool drawdown conducted in 1944-45 and 1945-46 included a small amount of experimental net operation, to study the effects of drawdown upon the movement of fish out of landlocked backwater areas. These studies indicated a definite movement out of the lake, during periods of falling water, of such

species as carp, northern, crappies, bowfin, and spotted sucker. The movement was intensified by a rapid drop in water level. This report deals with the operation of experimental nets in Pool 8 in January-February, 1947. During this particular winter there was no large drawdown of the pool.

Keywords: Fish, Movement, Ice

GREENBANK, J. 1947d. Creel census. UMRCC Invest. Rept. No. 16, 3 p.

Abstract: In the summer and winter fishing seasons of 1944 to 1946, the average angler on the Upper Mississippi River caught approximately one fish for every two hours of fishing effort, as shown by the intensive creel census conducted by the Upper Mississippi River Conservation Committee. In carrying out this analysis of fishing success, from three to seven clerks were employed during the different seasons, and tens of thousands of fishermen were interviewed. The section of the Mississippi River which was covered extended from Hastings, Minnesota to Dubuque, Iowa.

Keywords: Creel census, Fish, Survey

GREENBANK, J. 1947e. Catfish tagging. UMRCC Invest. Rept. No. 17, 1 p.

Abstract: How far and how fast do catfish move? In an attempt to answer this and other questions pertaining to the habits of this important fish, the fishery biologists of the Upper Mississippi River Conservation Committee carried out an extensive catfish tagging study.

Keywords: Fish, Survey, Distribution, Catfish

GREENBANK, J. 1947f. Fish population study, Miller Lake. UMRCC Invest. Rept. No. 18, 3 pp.

Abstract: Contrary to what a disconsolate fisherman may think after a luckless afternoon, many of the backwater areas of the Mississippi River bottoms are loaded with bluegills, crappies, and other game fish and panfish. This is the statement of the biologists of the Upper Mississippi River Conservation Committee, based on a fish population census of Miller Lake, near La Crosse, made

by netting and poisoning in August, 1947. In this 12-acre backwater lake were found over 14,000 bluegills, of which more than 3,200 were adults, a large proportion being of "eating" size. The total weight of the bluegill population of the lake was 750 pounds, or 62 pounds per surface acre. The lake also contained 325 northern pike, weighing 200 pounds, 300 largemouth bass, weighing 118 pounds, and numbers of other eatable fish such as bullheads, yellow perch, and crappies.

Keywords: Fish, Survey, Population

GREENBANK, J. 1947g. Activities in 1947 - northern unit. UMRCC Invest. Rept. No. 14. 4 pp.

Abstract: In the winter 1946-47, winter pool conditions again were studied, as a follow-up to the two preceeding winters' investigations. No pool drawdowns occurred in the northern section in the winter 1946-47. Conditions therefore were what might be considered "normal". In general, backwater areas held sufficient dissolved oxygen to sustain fish life, although in a few small, shallow areas oxygen depletion was noted. There was period of expended heavy snow cover, in early February, but (judging from oxygen samples) the snow left the ice just in time to avert considerable fish loss. Checks of the river bottoms, by plane and boat, made after the ice melted, failed to reveal any large amount of fish mortality. As a part of the winter studies, a two-way fish trap was operated for 40 days in the mouth of a backwater lake. This experiment demonstrated that snow cover on the ice had an effect upon the amount of fish movement into and out of the lake.

Keywords: Drawdown, Fish

GREENBANK, J. 1948a. Status of work projects, northern section, as of January, 1948. UMRCC Invest. Rept. No. 19. 2 p.

Abstract: In the Third Progress Report of the Technical Committee for Fisheries, dated January, 1947, there were listed a number of proposed future projects. This paper is a statement of the current status of these projects, as of January, 1948.

Keywords: Research

GREENBANK, J. 1948b. Work projects proposed for northern section for 1948. UMRCC Invest. Rept. No. 20, 2 p.

Abstract: This is a brief preview of the work program of the Northern Section for 1948. Most of the projects listed have been discussed and approved by the Fisheries Technical Committee and/or the Administrative Committee. They have been partially set up but additional ways, means, and details of procedure will have to be provided for by the Technical Committee and/or the field director.

Keywords: Research

GREENBANK, J. 1948c. Mississippi River fisheries survey. UMRCC Invest. Rept. No. 24, 5 p.

Abstract: The Upper Mississippi River is an important geographical feature for it forms a state boundary for Minnesota, Wisconsin, Iowa, Illinois, and Missouri. It is an important waterway of boat travel for pleasure and commerce. With its variety of water courses, its magnificent scenery, and its resources of fish and game, it is one of America's most important outdoor playgrounds. Of first rank in the assets of the river is its supply of many kinds of fish. This resource furnishes sport and recreational fishing to thousands of people, and at the same time supports a commercial fishing industry involving millions of dollars.

Keywords: Fish, Survey

GREENBANK, J. 1948d. Big river - big fish. UMRCC Invest. Rept. No. 27, 8 p.

Abstract: Discussion of the phenomenon that larger rivers tend to support larger sized fishes.

Keywords: Fish, Production, Age and growth

GREENBANK, J. 1948e. Proposed management recommendations. UMRCC Invest. Rept. No. 23. 10 pp.

Abstract: Sound management of a fishery resource should integrate three important factors: (a) the supply, as represented by the amount of fish present and the annual production, (b) the utilization or harvest, and (c) equitable division of harvest and benefits among all types

of participants. The first of these factors, the supply, is closely governed by many physical and biological factors. It may be assessed, at least roughly, but often cannot be adjusted to any great extent by management agencies. The second, harvest, can and should be adjusted and regulated, so that the proper balance between supply and harvest be maintained. For reasons well understood, neither an over- nor and under-utilization of the resource is desirable. The third factor, fair division of the take, is something most difficult to define and to achieve.

Keywords: Harvest, Fish

GREENBANK, J. 1948f. Mississippi River fisheries survey. Wis. Cons. Bull., 13(12).

Abstract: Like any other fishing resource, in fact like any resource belonging to the people and used by the people, the fishery of the Upper Mississippi River requires regulation and management, which in turn depends upon study and appraisal. Yet until very recently very little had been done in the way of study and survey of the fish and fishing of the river.

Enough thought by determined men leads to action, and answers can be found. Early in 1943, fishery management men in the several states involved began a series of conferences, discussions, and meetings, aimed at initiating a survey program.

The culmination of these conferences was a meeting, held in Dubuque, Iowa, in December, 1943, at which meeting the Upper Mississippi River Conservation committee was organized and brought into being. The primary purpose of this committee was established to be to carry out biological and economic studies of the fish and fishing, in the Mississippi River where it forms a boundary between the five states involved. Later in the life of the survey, it was extended to include studies of fur and game also.

Keywords: Survey, Fish

GREENBANK, J. 1949a. The fish crop: commercial production in the Upper Mississippi River with special reference to catfish. UMRCC Invest. Rept. No. 33. Mimeo. 9 p.

Abstract: Each year the Upper Mississippi River, between Hastings and Cairo, produces commercial fish in the amount of six to ten million pounds, of which 750,000 pounds is catfish (channel and flathead catfish). This is a lot of fish, and a substantial contribution to the protein food supply of the nation. It also amounts to many dollars, and a means of support for hundreds of fishermen. It also is the harvesting of a crop of the utilization of a resource.

Keywords: Upper Mississippi River, Commerical fishing, Catfish

GREENBANK, J. 1949b. Fishing on the Upper Mississippi River, 1948. UMRCC Invest. Rept. No. 34, 13 p.

Abstract: Because 1948 was suspected of being a better fishing year than previous years, a questionnaire was prepared and sent to conservation enforcement officers. This report is a summary of the tabulated replies to the questionnaire.

Keywords: Fishing, Upper Mississippi River

GREENBANK, J. 1949c. Increased vegetation growth in the Upper Mississippi River. UMRCC Invest. Rept. No. 36, 7 p.

Abstract: Information regarding the vegetation picture was obtained in three ways. First, a limited amount of observation of conditions was made during the summer of 1949 by the writer and other departmental field men. Second, the professional opinion of several authorities was secured either by correspondence or by oral discussion at a meeting of the Fish Technical Committee. Finally, a questionnaire was sent out to a considerable number of wardens, commercial fishermen, and other men who use and know the river.

Keywords: Upper Mississippi River, Vegetation

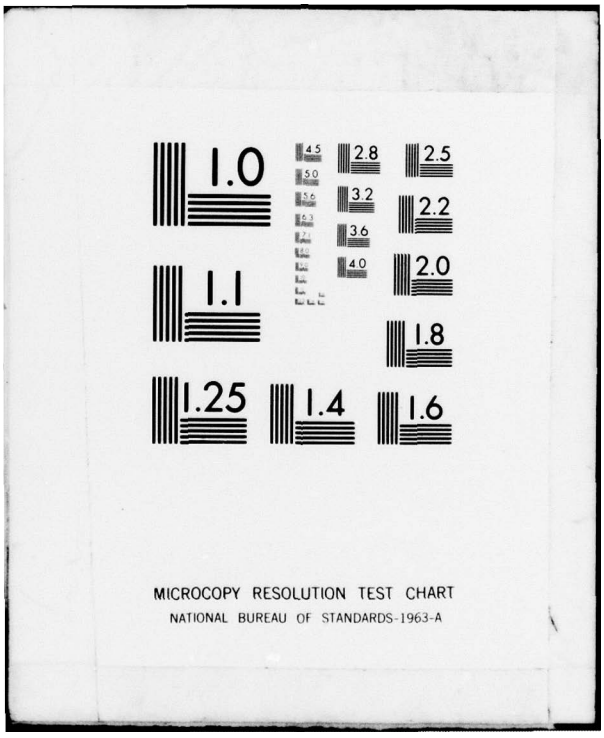
GREENBANK, J. 1949d. A quantitative estimate of sport fishing pressure and catch on the Upper Mississippi River. UMRCC Invest. Rept. No. 37, 25 p.

Abstract: In any analysis of the fishery, or any attempt a fish management, it is necessary to have some sort of estimate of the harvest. In theory, making such an estimate is simple: ascertain the number of fishermen and

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multiply by the average catch. But in dealing with practicabilities, the task becomes anazingly difficult.

Keywords: Upper Mississippi River, Sport fishing, Survey, Pressure, Catch

GREENBANK, J. 1949e. Comparative sizes of fish hooks (for trout lines). UMRCC Inves. Rept. No. 30. 7 pp.

Abstract: In defining and regulating trotlines for use in the commercial fishery of the Upper Mississippi River, it is necessary to stipulate the minimum size hook which may be used. Otherwise, the fishermen may use hooks of such small size as to capture and kill game fish or under-sized catfish. In the past, Wisconsin and Minnesota commercial regulations have read that trotline hooks had to be "of a size not less than 5/0", without further definition or restruction. This lack of specification has created much confusion because of the wide differences in actual dimensions of hooks of the same stated size (as "5/0") but of different pattern, style, of manufacture. No fisherman, enforcement agent, or administrator, knows exactly what a "5/0" hook is. Attention is now focused on the problem because of a recent proposal that the legal hook size be reduces. The fisheries committee of the UMRCC conducted a special trotline study in the summer of 1948. It was found that hooks as small as 2/0 (Kirby system) may be used without undue harm to game fish or small catfish. Accordingly, a recommendation has been made by the Committee that the legal minimum hook size should be reduced. This recommendation was brough before the public hearings on river orders in November, 1948, and was favorably received. Furthermore, the opinion of the greater share of the fishermen, enforcement officers, and administrators is that hook size reduction is in order and would bring about a more efficient harvest of the resource.

Keywords: Fishing, Equipment

GREENBANK, J. and M. MONSON. 1947. Size and maturity of channel catfish. Upper Mississippi River Conserv. Comm. Tech. Cons. Fish Prog. Rept., 3: 28-31.

Abstract: During the summer of 1946, a large number of channel Catfish (Ictalurus lacustris punctatus) were examined at fish markets on the Upper Mississippi River. Nearly all of this work was done at the markets at Bay City,

Wisconsin, and Muscatine and Lansing, Iowa. The data presented below are a composite of figures from all three of these localities.

Each specimen was measured (total length in inches and tenths) and weighed (in pounds and hundredths), and its gonads carefully examined to ascertain the state of sexual development. The system of classifying the degree of sexual maturity which was used was designed somewhat arbitrarily, in order to fit the needs at hand.

The bulk of specimens examined came from the catches of commercial fishermen. They were taken by various kinds of gear: at Bay City, chiefly seines; at Muscatine and Lansing, trotlines, basket traps, and hoop nets. Not only are these types of gear somewhat size selective, but also the legal catch is restricted to fish over certain prescribed minimum lengths, which vary with the different states.

Keywords: Fish, Life history

GREENBANK, J. and D. J. O'DONNELL. 1948. Growth studies of fish-the use of hydraulic presses in making scale impressions. UMRCC Invest. Rept. No. 21, 7 p.

Abstract: The method of using scales for the determination of rates of growth in fishes is quite old. Various systems for the interpretation of data have been formulated and the validity of the annulus as a year mark has been tested and accepted. The usual procedure has been to select certain scales by examination under the microscope, washing these scales after selection, and mounting in gelatin or other media on a glass slide, and examination and measurement of the scales being performed with the aid of a microprojection machine.

Keywords: Research, Fish, Age and growth

GREENE, C. W. 1935. The distribution of Wisconsin fishes. Wis. Cons. Comm., Madison. 235 p.

Abstract: The distribution of native Wisconsin fish is discussed. Also included are habitat descriptions and food habits.

Keywords: Fish, Wisconsin, Distributio

GRIEBENOW, G. W. 1973. Levels of Assessment. Water Spectrum. 5(2): 24-29.

Abstract: The Upper Mississippi River Basin Commission's primary function is coordination of studies on the Mississippi basin. The article briefly discusses the work being done by the Commission and their hopes for the future.

Keywords: Commerical boat traffic, Recreational boat traffic

GRIER, N. M. 1922. Final report on the study and appraisal of mussel resources in selected areas of the Upper Mississippi River. Am. Midl. Nat. 8: 1-33.

Abstract: During the months of July and August 1920, the U.S. Bureau of Fisheries made a study and appraisal of the mussel resources of the Mississippi River in and between the areas commencing at a point about five miles above Red Wing, Minnesota, extending thence through Lake Pepin, and ending nearly 80 miles downstream at La Moille, Minnesota. More exact boundaries for the areas will be indicated hereafter. The work carried on was with reference to recent administrative action on the part of the states of Wisconsin and Minnesota, which provided for the closure of certain of these areas for the protection of the fresh water mussels, as well as for areas to remain subject to fishery. From the data acquired in this investigation, it is expected to establish a basis for comparison of conditions in the present and after a period of protection.

Keywords: Upper Mississippi River, Mussels, Distribution, Benthos

GRIER, N. M. 1926. Report on the study and appraisal of mussel resources in selected areas of the Upper Mississippi River. Am. Midl. Nat. 10: 89-110.

Abstract: During August and September 1925, U.S. Bureau of Fisheries repeated a study and appraisal of the mussel resources in certain selected areas of the Upper Mississippi River, originally made in July and August 1920. The data acquired in 1920 was expected to form a basis for comparing the conditions of that time with those of 1925, after a period of protection.

Keywords: Mussels, Upper Mississippi River, Distribution, Benthos

GRIER, N. M. and J. F. MUELLER. 1922. Notes on the naiad fauna of the Upper Mississippi River. II. The naiads of the Upper Mississippi drainage. Nautilus 35: 46-49; 96-103.

Abstract: The following notes are based largely upon the examination of material of fresh-water mussels, which the Carnegie Museum has received in part from G. H. Clapp, in part from the Alabama Museum of Natural History - it has been collected mostly by H. H. Smith and his assistants, but a few forms have been taken by myself in northern Georgia and Tennessee.

Keywords: Upper Mississippi River, Invertebrates, Mussels

GRUENKE, Br. M. 1969. The influence of Hyalella azteca on the total coliforms in a lotic environment. B.S. Thesis, St. Mary's College, Winona, MN. 49 p.

Abstract: Previous surveys of coliform density in the Mississippi River indicated that the invertebrate population might conceivably be contributing to the coliform population. This investigation was initiated to determine if one common, river invertebrate, Hyalella azteca, contributes significantly to the total coliform population. One liter of river water was placed in a control tray and in each of 2 experimental trays. Both experimental trays also contained 100 Hyalella azteca. The total coliform densities of all 3 trays were measured at the start of the experiment and every 6 hours thereafter over a 4-day period. This experiment was conducted twice. In both cases it was observed that the total coliform density in all 3 trays decreased over time. Statistical analysis showed that no significant difference existed between the decrease in total coliform density over time measured in the control trays and in that measured in the experimental trays.

Keywords: Bacteria, Invertebrates, Benthos

GUILLORY, V., SR. 1975. Zoogeographical implications of small stream fishes in the Mississippi River. ASB (Assoc. Southeast Biol.) Bull. 22(2): 56.

Abstract: The Mississippi River, because of its size, high turbidity, and sediment level, appears to constitute a barrier to fishes primarily adapted for life in clearer upland reaches of tributaries. The occurrence of certain small stream fishes in the lower Mississippi River on a transient basis may have illustrated the process of tributary hopping (i.e., infrequent movements via the main channels of large rivers from one habitable tributary to the next). Records of Notropid longirostris in the Mississippi River during three successive

winters appeared to be due to a deliberate behavioral mechanism, while floodborne stranglers or waif immigrants accounted for the presence of five other small stream fishes in the Mississippi River.

Keywords: Fish, Distribution, Zoogeography

GUNNING, G. E. and W. M. LEWIS. 1955. The fish population of a spring-fed swamp in the Mississippi bottoms of southern Illinois. Ecology. 36(4): 552-558.

Abstract: Primary emphasis was placed upon the fish population; however, a collection of other animals as well as aquatic plants was taken with the purpose of providing a more comprehensive view of this rather unique community. This work does not constitute a complete faunisitc or floristic survey. The Pine Hills area is of interest of zoologists and botanists alike due to the fact that it represents a natural, undisturbed swamp area which probably contains much of its original flora and fauna.

Keywords: Illinois, Fish, Population, Wetlands

GUNTER, G. 1957. Wildlife and flood control in the Mississippi Valley. Trans. 22nd N. Am. Wildl. Conf. 189-196.

Abstract: Flooding from the Mississippi River has been controlled by levees and canalization which leads to better hydraulics for the system.

Keywords: Flooding, Wildlife

HAITES, E. F. 1969. Ohio and Mississippi River Transportation 1810-1860. Ph.D. Thesis, Purdue University. 277 p.

Abstract: The study was confined to the operations of the major types of river craft - keelboats, flatboats, and steamboats - in the Louisville - New Orleans trade.

The study estimated the costs and revenues associated with the operation of the different types of river craft for each decade that these craft were operating in the Louisville - New Orleans trade. An examination of the activities of the municipal, state and federal governments in the fields of river and port improvement, regulation of the activities and safety standards of the river craft, and the awarding of mail contracts revealed that their impact was minor and sporadic. The government activities did not substantially affect the operations of the river craft in the Louisville - New Orleans trade.

Keywords: Ohio River, Commercial boat traffic, Recreational boat traffic, Navigation.

HALL, R. J. 1975. Life history, drift, and production of the stream mayfly Tricorythoses atratus McDunnough in the headwaters of the Mississippi River. Ph.D. Thesis, University of Minnesota. 238 p.

Abstract: A study of mayfly distribution, drift and production in the headwaters of the Mississippi River. Discussion of seasonal abundances and life history.

Keywords: Production, Ecology, Distribution, Invertebrates, Minnesota, Mayflies, Life history

HALL, T. R. 1969. Determination of the multiple correlation between total and fecal coliforms with temperature, turbidity, and current in Pool 6 of the Mississippi River, Winona, Minnesota. M.S. Thesis, St. Mary's College, Winona, MN. 25 p.

Abstract: A study was made to determine the multiple correlation between total and fecal coliforms with temperature turbidity and current in Pool 6 of the Mississippi River during the period from March of 1969 until July of 1969.

The membrane-filter technique for determining densi-

ties of coliform bacteria was applied to water samples collected at three transects in the river.
It was found that the river along the three transects, and from top to bottom could be considered homogeneous for both fecal and total coliforms. There is a strong multiple correlation (99%) for the influence of temperature, turbidity, and current on coliform densities. The most important single factor affecting the coliform density was that of temperature followed by turbidity and current.

Keywords: Bacteria, Temperature, Turbidity, Pool 6.

HANEY, P. D. 1975. Consultant Viewpoints - effluent guidelines for water treatment plant waste disposal. AWWA 95th Annual Conf., Minneapolis, MN.

Abstract: In 1972, wastes from 15 water treatment plants on the Missouri and Mississippi Rivers in Nebraska, Kansas, and Missouri were studied. River sediment solids recycled to the river from the water plant presedimentation basins could not possibly affect the quality of the swift, muddy lower Missouri River. The present procedure of direct discharge is cost effective and without environmental impact. Application of uniform criteria for waste control and treatment is not a realistic procedure. Technical report.

Keywords: Missouri River, Missouri, Sediment, Discharge, Water quality, Siltation

HANNAN, A. 1969. Study of Mississippi River bends. Ph.D. Thesis, Colorado State University. 253 p.

Abstract: Criteria have been developed to help predict the optimum channel shape and alignment for stable conditions based on studies of various hydraulic and geometric parameters of stable and unstable reaches of Mississippi River. Study also shows that stable reach sections have well defined ranges and are associated with lower energy gradients and smaller width-depth ratios than the unstable reach sections. Comparison of the relations developed here for a larger system like the Mississippi with those of smaller systems such as regime canals and small rivers indicates that the hydraulics of larger systems should not be extrapolated from the experimental hydraulic relations applicable to smaller systems. Depending upon the given conditions, various types of sections

are suitable based upon the design criteria developed. This is illustrated by example problems.

Keywords: Hydrology

HANNON, M. R. 1967. Determination of fecal-coliform densities in Pool 6 of Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 27 p.

Abstract: The membrane-filter technique for determining fecal coliform densities was applied to samples collected from Pool 6 of the Mississippi River. Techniques were developed for accurately analyzing sewage effluents and river water. General trends were observed and it was found that fecal coliforms accounted for less than 4.5% of the total coliform density in effluent samples. Fecal coliform densities did follow the same trends as total coliform densities in river water, but were present at a much lower density.

Keywords: Bacteria, Pool 6, Effluent

HANSEN, D. F. 1951. Biology of the white crappie in Illinois. Ill. Nat. Hist. Surv. Bull. 25(4): 211-266.

Abstract: This paper is based largely on white crappie studies carried on by the writer at Lake Decatur, Macon County, Illinois, during the period beginning in late November, 1935, and ending in early December, 1939. Most of the fish for the Lake Decatur studies were caught in hoop nets that were operated at 1- to 2-month intervals at all seasons of the year.

Year-round collecting at Lake Decatur provided material on the white crappie for determination of spawning time, length of the annual growing period, seasonal fluctuations in plumpness, time of year of high natural mortality, and date of annulus formation. In addition this collecting brought to light seasonal variations in sex ratios and evidence that the hoop net is less efficient for capture of crappies in warm weather than in cold weather.

Keywords: Fish, Illinois, Crappie, Life history

HANSON, G. H. 1952. Noncommercial fishing in the Upper Mississippi River. Proc. Ann. Meeting, Upper Mississippi River Conservation Committee, 8: 51-69.

Abstract: This paper is a summary of 4 years' data on noncommercial fishing in the Upper Mississippi River between Minneapolis, MN, and Alton, IL. Four types of data are discussed; lockmaster's daily counts of fishermen, all-day counts of fishermen, aerial counts, and creel census.

Keywords: Fishing, Upper Mississippi River

HARDEN, P. H. and C. E. MICKEL. 1952. The stoneflies of Minnesota (Plecoptera). Univ. of Minn. Agr. Exp. Sta. Bull. 201: 1-84.

Abstract: Discussion of economic importance, biology of nymphs, methods of association, rearing and collecting, preservations and study. Keys to families and subfamilies. Biology, taxonomy, and distribution of species.

Keywords: Invertebrates, Minnesota, Stoneflies, Keys, Distribution, Taxonomy

HARDY, J. W. 1957. Least tern in Mississippi Valley. Michigan State Univ. Mus. 1(1): 1-60.

Abstract: This study of the interior Least tern is divided into three parts: 1) a field study at Bell Island, Illinois; 2) an analysis of published information; and 3) correspondence with ornithologists throughout the range of the subspecies. The migration, breeding, and distribution of the species is discussed.

Keywords: Birds, Least tern

HARMESON, R. H., T. E. LARSON, L. M. HENLEY, R. A. SINCLAIR and J. C. NEILL. 1973. Quality of surface water in Illinois, 1966-1971. Bull. Ill. St. Water Survey #56, Urbana, Illinois

Abstract: Surface water quality in Illinois has been determined by means of analysis of data from monthly water sampling programs. Sampling programs spanning periods of approximately 5 years have been carried out since 1945. Data for the period 1966-1971 are for 25 streams at 30 sampling locations. Data analyzed to show frequencies of median and extreme values of certain mineral constitutents for specific streams and sampling periods provide baseline values for future water quality and water resource studies. Comparisons are drawn between water quality for the same stations in two or more

sampling periods and with applicable Illinois Pollution Control Board regulations.

Keywords: Water quality, Illinois

HARRIS, A., L. F. BLAIR, W. T. LAMM, H. FELSTEHAUSEN, and T. A. AUSTIN. 1976. Problem identification and ranking. A selected review of techniques used by public agencies. Water resources research center. University of Illinois, Urbana. 106 p.

Abstract: Three aspects of water and related land resource problem identification and ranking procedures are investigated: (1) past approaches to problem identification and ranking in the Upper Mississippi River Basin; (2) an overview of present identification/ranking activities in eight selected agencies and governmental levels; and (3) a detailed investigation of identification/ranking procedures as developed within a single federal agency.

Keywords: Research, Upper Mississippi River

HARRIS, P. C. and W. R. POSEY. 1973. Model and Prototype Analysis of the Old River Diversion on the Mississippi River. Army Corps of Engineers, Vicksburg, Miss. 26 p.

Abstract: In order to prevent the capture of the Mississippi River by the Atchafalaya River, two control structures were built on the west bank of the Mississippi River approximately 10 miles upstream from Old River. A side draft developed at the entrance to the low sill control structure tending to pull tows toward the structure. A model of the reach was constructed at Waterways Experiment Station to develop a plan to improve the situation. The plan for improving the condition was to develop the pool along the left bank with the crossing near the entrance to the structure stabilizing the channel into its former alignment. The results of the model tests were that the

dike field filled and the bar on the opposite side receded. By keeping the dike profiles low and sloping, scour around the dikes may be held to a minimum. This type of a design allows the river to adjust slowly to a dike field rather than fight it.

Keywords: Dike, Training structure, Closing structure, Models

HARRIS, S. W. 1957. Ecological effects of drawdown operations for the purpose of improving waterfowl habitat. Ph.D. Thesis, University of Minnesota. 205 p.

Abstract: The objectives of this study were to determine the vegetation changes resulting from the manipulation of water levels, and the value of these changes to wildlife. The study consisted of a vegetation phase and a wildlife utilization phase.

Keywords: Waterfowl, Habitat management, Wildlife, Vegetation, Drawdown

HARRISON, H. 1962. Want to catch a big fish? Iowa Conserv., 21(7): 49-55.

Abstract: In Iowa waters the flathead catfish can weight up to 40 pounds. Big flatheads are not usually caught unless you know how, when and where to catch them. Live bait is the best on a heavy willow pole. The best time to fish for flatheads is late at night in July and August.

Keywords: Fishing, Recreation

HARTKE, W. O. 1966. The stone-fill dike in the middle Mississippi. Tech. Rept. No. 1, (Vol. 4, Chapt. II) Corps. of Engr. Comm. on Chan. Stab. Waterways Exp. Sta. Vicksburg, Miss.

Abstract: The stone-fill dike is now being used exclusively for contracting the Middle Mississippi River. Tried and tested over the last three years, it has proven to be vastly more effective, usually cheaper to construct, and always cheaper to maintain than timber dikes. It is indestructible by the actions of floods, drift, ice, and indifferent towboat operators.

Keywords: Dike, Flood, Ice

HARTMANN, E. C. 1977. Outdoor recreational use of Pool 9 of the Mississippi River. Ph.D. Thesis, University of Utah. 151 p.

Abstract: The problem was to determine the nature and extent of outdoor recreational use of Pool 9 of the Mississippi River. During this study it was determined how many people used Pool 9 and for what purpose, hours spent

at the Pool, numbers of species of fish caught, and access points to the Pool which received greatest use.

Keywords: Pool 9, Recreation, Fishing

HARTSOUGH, M. L. 1939. From canoe to steel barge on the Upper Mississippi. Univ. Minn. Press.

Abstract: A book which reviews the observations of many persons concerning the effect of a river on the life of a nation over some two hundred years. The chapters review what we know of the activities on and along this river from the time it was first discovered.

Keywords: History, Commercial boat traffic

HAUPERT, R. G. 1976. Effects of a proposed chemical effluent from a coal-fired generating plant on invertebrate drift. M.S. Thesis, St. Cloud State Univ., St. Cloud, MN. 43 p.

Abstract: An artificial stream apparatus was designed to assay the effects on invertebrate drift of the proposed chemical effluent from the Northern States Power Company's Sherburne County Generating Plant near Becker, Minnesota. Two artificial streams with controlled light, temperature and flow rate were used. Chemical effluents consisted mainly of $CaSO_4$ and $MgSO_4$ with various heavy metal sulfates.

A drift net collected invertebrates at the end of each stream for 24, 48, 72 and 96 hours. Accumulated percent drift vs. time were plotted for densities and biomass for Trichoptera, Ephemeroptera, Diptera and total organisms for 0%, 50%, 25%, 12.5%, and 6.25% effluent concentrations.

Keywords: Chemistry, Effluent, Power, Invertebrates

HAVIGHURST, W. 1944. Upper Mississippi, a wilderness saga. Farrar and Rinehart, Inc., New York. In: The Rivers of America series. 258 p.

Abstract: This book describes the settling of the wilderness near the Mississippi River. Sections of the book deal with the Viking's second coming, breaking the paririe sod, the epic of lumber, and the prairie wind.

Keywords: History

HAVIGHURST, W. 1964. Voices on the river; the story of the Mississippi waterways. MacMillan Co., New York. 310 p.

Abstract: An historical story of a journey down the Mississippi with discussion of the steamboat traffic and industry in towns on the shores.

Keywords: History, Commercial boat traffic, Recreational boat traffic

HAVLIK, M. E. 1978. Wisconsin Shell Game. Wis. Dept. Nat. Res. 2(4): 5-8.

Abstract: A general discussion of Wisconsin's freshwater clams describing physical characteristics, life history, and their commercial value. Pictures are also presented of the species found in Wisconsin waters.

Keywords: Clams, Wisconsin

HAYES, J. 1973a. Over-wintering Culex pipiens pipiens in the Ohio-Mississippi River basin, 1962-1967. Mosq. News. 33(3): 424-428.

Abstract: Attempts were made to isolate SLE Virus from C. pipiens collected in the Ohio-Mississippi River Basin each winter from 1962 through 1967. No virus was isolated. The various species of hibernating mosquitoes are described in numerous sites. The duration and breaking of hibernation in pipiens is documented. The occurrence of gonotrophic dissociation in a natural hibernating site was demonstrated as well as the ability of pipiens to hibernate successfully without blood.

Keywords: Ohio River, Illinois, Mammals, Invertebrates, Wintering

HAYES, J. 1973b. A study of the Culex pipiens pipiens in the Ohio-Mississippi River basin in relation to St. Louis encephalitis. Mosq. News 33(3): 447-454.

Abstract: Following the 1964 outbreak of SLE virus in McLeansboro, Illinois, this virus was isolated from Culex pipiens complex mosquitoes each year through 1967. Studies were conducted in St. Louis County, Missouri during and SLE outbreak in 1965 and surveillance was continued over the next 2 years. An intensive effort was made in McLeansboro to determine which members of the complex were present throughout the year by reading progeny from selected wild captured females. The DV/D ratios were

used to distinguish quinquefasciatus from pipiens; autogeny was the test for molestus. Precipitin studies on wild caught females of the complex were processed in all study sites.

Keywords: Ohio River, Invertebrates, Mammals, Birds, Disease

HEFFELFINGER, J. A. 1973. A seasonal survey of certain physical and chemical factors and plankton at three locations in Pool 20 of the Mississippi River. Unpublished M.S. Thesis, Western Ill. Univ., Macomb, IL.

Abstract: Samples were taken at the surface and at 1 m and 2 m depths at 3 sites in Pool 20 of the Mississippi River from 22 June 1972 to 8 March 1973. Weekly determinations were made of air and water temperatures, dissolved oxygen, current velocity, turbidity, settleable solids, color, carbon dioxide, alkalinity, pH, and plankton.

Stream discharge was found to have a controlling influence over most factors studied. Air temperature was found to be an important factor in determining water temperature. Dissolved oxygen concentrations were inversely related to water temperature. Fluctuations in pH were determined to be directly related to alkalinity values and were generally inversely related to carbon dioxide concentration fluctuations. The variations in plankton were found to have accompanied variations in oxygen, but had an inverse relationship to stream discharge, current velocity, and turbidity.

Keywords: Pool 20, Limnology, Plankton, Water quality, Habitat alteration

HEIDINGER, R. C. 1974. 1st record of the northern studfish Fundulus catenatus new record cyprinodontidae pisces in Illinois USA. Trans. Ill. State Acad. Sci. 67(3): 364-365.

Abstract: In July 1973 a single female specimen was found in the Mississippi River in Alexander County, Illinois. The habitat at the collection site is atypical for the northern studfish, and it remains to be seen if populations will become established in Illinois streams.

Keywords: Fish, Survey, Illinois, Habitat, Rare species

HEIN, D. 1961. Wood duck roosting flights at Paint Creek, Iowa. Proc. Iowa Acad. Sci. 61:264-270.

Abstract: Wood duck roosting flights were studied at a marsh near the mouth of Paint Creek, Allamakee County, Iowa, during late summer and fall of 1959 and 1960. Evening roosting flight counts were superior to morning counts for estimating roosting populations. Changes in times of flights and illumination associated with flights were noted as the season advanced. The roosting population built up to a pre-migration peak in mid-September. Counts fluctuated erratically after migration started about October 1, and the roost was abandoned in early November. Data collected at Paint Creek Roost were typical in general of those collected at the other 20 roosts investigated. Comparison of pre-migration populations by annual counts made about September 20 can be expected to show year-to-year changes in the Paint Creek Roost wood duck population.

Keywords: Ducks, Iowa

HEISE, R. A. 1969. Some observations on a autumn sampling of game fish in Pool 6 of Upper Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 28 p.

Abstract: The purpose of this study was to observe the distribution, age, and condition coefficient of five game fish --Northern Pike, Black Crappie, Walleyed Pike, Largemouth Bass, and White Crappie--during the autumn of 1968 by an electrofishing method in Pool 6 of the Upper Mississippi River. It was found during the study period that the distribution of the fish was severely altered due to high water. Fish were obtained exclusively from a backwater environment. A scale analysis technique was employed to determine the age of our specimens. It was found they ranged from 1 to 6 years of age. The coefficient of condition was calculated for all fish and showed that Largemouth Bass in Pool 6 had average condition coefficient values while Black Crappies, Northern Pike, Walleyed Pike, and White Crappies had condition coefficients well above average. Spring and summer surveys of the same area showed the coefficient of condition to be very similar with values obtained during this study.

Keywords: Sport fishing, Pool 6, Upper Mississippi River, Distribution, Age and growth, Condition

HELD, J. W. 1978. Environmental impact of dredged material disposal on the Upper Mississippi River at Crosby Slough. Riv. Studies Cen. Univ. Wis., LaCrosse. Rept to U.S. Army Engr. Waterways Exp. Sta., Vicksburg, Miss.

Abstract: This study was designed to investigate the environmental effects of disposal of material from maintenance dredging on the aquatic habitat around Island 117, Pool 8, Upper Mississippi River. Dredging impacts of disposal of dredged material in the past have included the conversion of productive aquatic and semiaquatic habitat to sandy shoals and islands, as well as the impairment of backwater circulation.

Keywords: Dredging, Pool 8, Slough, Wisconsin

HELLBERG, J. M. 1948. A study of the vertical distribution of the plankton in Lake Itasca, Minnesota, during August 1947. M.A. Thesis, Univ. Minnesota.

Abstract: The purpose of this paper is to record and compare observations of the vertical distribution of the plankton in Lake Itasca, Minnesota during four twenty-four hour periods in August 1947 and to determine the influence of the prevailing chemical and physical conditions on the vertical distribution of the plankton.

Keywords: Plankton, Distribution, Minnesota

HELMS, D. R. (Undated). Progress report on the first year study of northern pike in the Mississippi River. Iowa State Cons. Comm.

Abstract: Vital statistics from northern pike populations in Pools 9, 10, 13, and 14 in the Mississippi River bordering Iowa were determined to appraise the suitablity of this species as a commercial food-fish. Five hundred eighty northern pike were marked with serially numbered Floy tags in 1974 and 429 during 1975. An additional 300 were marked by fin excision to measure tag loss in Pool 9. Ten marked by fin excision to measure tag loss in Pool 9. Ten marked fish were recaptured in 1974. One fish tagged in 1974 was recaptured in 1975 and 4 tagged in the concurrent season were recaptured. Male northern pike were more prevalent in net catches than females, comprising up to 70% of the catch in the upper pools. Age of fish captured ranged from I to IX with ages II-IV most numerous. Total annual mortality was estimated at 68% for male and 66% for female northern pike in all pools. Ova production

averaged 28,333 per kg of body weight. Response to a questionnaire sent to commercial fishermen varied widely while those in the upper pools were interested. Former fishing seasons on this species produced commercial catches of 46,000 to 113,600 pounds annually. During commercial processing for food, northern pike lost up to 58% of their whole body weight. A literature review of chemical contamination of northern pike flesh was completed and proved inconclusive.

Keywords: Fish, Population, Age and growth, Pike, Northern pike

HELMS, D. R. 1964. 1964 Annual Survey of the Coralville Reservoir Fish Population. Iowa St. Cons. Comm., Quart. Biol. Repts., 16(4): 32-38.

Abstract: The results of the 1964 annual survey whose purpose is to maintain a continuous inventory and anticipate changes in the fish population in order that management techniques can be recommended and evaluated.

Keywords: Fish, Iowa, Population

HELMS, D. R. 1966a. 1965 Commercial Fishing Statistics for the Mississippi River bordering Iowa. Iowa Cons. Comm., Quart. Biol. Repts., 18(3): 23-25.

Abstract: There were 384 licensed owners of commercial fishing gear on the Mississippi River in 1965. Each of these fishermen was furnished forms and instructions for recording their catch by weight, species, pools fished and gear used. Failure or refusal to return the completed forms is -- "cause for the Commission to refuse issuance of license renewal until such report is made." This report is a summary of these data reported by the 222 commercial fishermen who completed and returned the required forms.

Keywords: Fish, Commercial fishing, Iowa

HELMS, D. R. 1966b. 1965 - Officer Contact Creel Census for the Mississippi River. Iowa Cons. Comm. Quart. Biol. Repts., 18(4):34-35.

Abstract: A presentation of data collected in 1965 giving number of anglers, total hours fished, and number and species of fish caught.

Keywords: Creel census, Iowa

HELMS, D. R. 1967a. 1966 officer contract creel census for the Mississippi River. Iowa Cons. Comm., Quart. Biol. Repts., 19(1):33-34.

Abstract: A presentation of data collected in 1966 giving number of anglers, total hours fished, and number and species.

Keywords: Creel census

HELMS, D. R. 1967b. Trends in channel catfish harvest in the Mississippi River. Iowa Cons. Comm., Quart. Biol. Repts. 19(4):27-31.

Abstract: The report discusses recent trends in channel catfish harvest in the Iowa segment of the Mississippi River from 1955 through 1967.

Keywords: Fish, Harvest, Channel catfish, Catfish

HELMS, D. R. 1967c. Progress report on the 1967 Mississippi River channel catfish studies. Iowa Cons. Comm., Quart. Biol. Repts., 19(3):46-53.

Abstract: Samples of small channel catfish were netted in the Mississippi River in 1967. Special attention was devoted to 4 pools. Although spines samples have not been aged, length-frequency data indicates a strong 1965 year-class in most pools. Maximum growth was observed in July and August. Drag-seine samples indicate spawning failure in pool 9, while moderate numbers were found in pools 11 and 13. There was an abundance of young-of-the-year in pool 10.

Keywords: Fish, Population, Channel catfish, Catfish

HELMS, D. R. 1968a. Comparative growth of channel catfish from stunted and normal populations. Iowa Cons. Comm., Quart. Biol. Repts., 20(1):12-13.

Abstract: Samples of channel catfish from stunted and normal populations were stocked together in small ponds. A comparison of growth increments indicated growth was more rapid in the stunted fish than a normal stock.

Keywords: Age and growth, Fish, Population, Channel catfish, Catfish

HELMS, D. R. 1968b. Aquatic habitat of the Mississippi River navigation Pools 11 and 18. Iowa Cons. Comm., Quart. Biol. Repts., 20(2):19-23.

Abstract: The different aquatic habitats of Mississippi River navitation pools 11 and 18 were mapped according to classification proposed by the UMRCC. Pool 11 was found to consist of 0.3% tail waters, 11.9% main channel, 8.9% main channel border, 7.7% side channel, 60.7% of 0.7, 22.1, 20.4, 14.8, 31.6, 1.5 and 9.0 of each habitat respectively. Maps were reproduced on legal size paper for field use.

Keywords: Habitat, Pools 11 and 18

HELMS, D. R. 1968c. Aquatic habitat of the Mississippi River bordering Iowa. Iowa Cons. Comm., Quart. Biol. 20(4): 11-14.

Abstract: The aquatic habitats of the Mississippi River bordering Iowa were mapped according to a habitat classification proposed by the UMRCC. Habitat was found to consist of 0.6% tail water, 16.6% main channel, 13.9% main channel border, 10.7% side channel, 16.2% slough, 41.6% lake and 0.3% pond. Maps of individual pools were reproduced on legal size sheets for field use.

Keywords: Habitat, Iowa

HELMS, D. R. 1969a. Projected changes in aquatic habitats of the Mississippi River associated with pool level raises. Iowa Cons. Comm. Quart. Biol. Repts., 21(2): 46-58.

Abstract: The proposed 12-foot navigation channel for the upper Mississippi River has created a need for a method of porjecting changes resulting from different pool level raises. This paper proposes a method for determining aquatic habitat changes. Alterations in habitat are calculated by this method for pools 9 through 19 for one, two and three foot pool level raises.

Keywords: Habitat, Flooding, Drawdown

HELMS, D. R. 1969b. Preliminary results of slime distribution studies on the Mississippi River. Iowa Cons. Comm. Quart. Biol. Repts., 21(3): 25-28.

Abstract: A study was initiated in the Dubuque area to determine seasonal density and distribution of the slime bacteria,

Sphaerotilus natans. Preliminary sampling indicate the slime bed is limited to the Iowa side of the river and has a minimum downstream distribution of 6.5 miles. No conclusion has been reached relative to seasonal density at this time because variation in river discharge during the sample period tended to mask quantitative trap results.

Keywords: Pollution

HELMS. D. R. 1969c. Fifteen-inch size limit proposal for channel catfish in the Mississippi River. Iowa Cons. Comm., Quart. Biol. Repts., 22(4): 49-54.

Abstract: This report is an explanation of why a 15-inch size limit has been recommended for the upper Mississippi River. Raising the size limit is expected to expand channel catfish production to a more optimum level. Commercial harvest would consist of fewer, but larger, fish having a higher total value, while sport harvest would increase significantly in both number and size of fish. Projected changes in sport and commercial harvest are presented in tabular form for two sample pools.

Keywords: Fish, Age and growth, Channel catfish, Regulations, Catfish

HELMS, D. R. 1969d. Habitat use by Mississippi River anglers. Iowa Cons. Comm., Qurt. Biol. Repts., 21: 33-54.

Abstract: Habitats with the lowest catch rates included tailwaters, main channel borders and the main channel.

Keywords: Fish, Creel census, Habitat, Pools 11 and 18.

HELMS, D. E. 1970a. Slime distribution studies on the Mississippi River (progress report 2) Iowa Cons. Comm., Quart. Biol. Repts., 22(1): 45-48.

Abstract: Continued study of density and distribtuion of slime bacteria originating in the Dubuque area demonstrated a marked increase during the winter. In February, slime was detected 52 miles below the Dubuque sewage treatment plant. It probably extended much farther, but slime originating from Clinton would have masked any results had sampling continued downstream.

Keywords: Pollution

HELMS, D. R. 1970b. Sturgeon harvest in the Mississippi River bordering Iowa. Iowa Cons. Comm., Quart. Biol. Repts., 22(3): 55-60.

Abstract: The ranges in the commercial harvest of sturgeon in Iowa since 1954 was 58,591 lbs in 1958 and 5,249 lbs in 1962. The 10-year mean for 1960 through 1969 was 12, 625 lbs which had a market value of $2,746.86 to the fishermen. Maximum value was $9,960.47 in 1958.

Keywords: Fish, Iowa, Harvest, Sturgeon

HELMS, D. R. 1970c. Commercial fishermen's reactions to a proposed fifteen inch commercial catfish size limit. Iowa Cons. Comm., Quart. Biol. Repts., 22(3): 13-25.

Abstract: A questionaire distributed to 175 Iowa commercial fishermen reporting a significant catfish harvest disclosed that 34% approved changing the size limit on catfish from 13 to 15 inches. Fifty-three percent opposed the change, while 13% were undecided. Four alternative changes met with similar disapproval, and the majority wanted no change from present regulation.

Keywords: Commercial fishing, Age and growth, Regulations, Channel catfish, Catfish

HELMS, D. R. 1970d. Paddlefish harvest in the Mississippi River bordering Iowa. Iowa Cons. Comm., Quart. Biol. Repts., 22(2): 1-3.

Abstract: A summary of the river's paddlefish fishery has been compiled. Catch records, price of fish and catch by gear are also discussed.

Keywords: Fish, Iowa, Harvest, Paddlefish

HELMS, D. R. 1970e. Open-water walleyes. Iowa Cons. 29(1)

Abstract: Winter fishing for walleye and sauger of the upper reaches of the Mississippi River is generally confined to the open water areas immediately below the navigation dams. Specific types of fishing gear and methods vary from one locality to another. Prime walleye fishing continues until the ice begins to break up in the spring.

Keywords: Walleye, Sauger

HELMS, D. R. 1972. Progress Report on the first year study of Shovelnose sturgeon in the Mississippi River. Annual Progress Report for Progect 2-156-R-1. Iowa Cons. Comm., Des Moines, IA.

Abstract: Field operations of Federal aid Project 2-156-R-1 were started July 1971 at the Mississippi river bordering Iowa. The study was designed to investigate commercial shovelnose sturgeon harvest, study the life history and evaluate the present reporting system. Samples totaling 2,188 commercially harvested sturgeon were examined.

An additional 2,156 were captured for life history studies. One thousand eight hundred eighty-two were tagged, and Schnabel population estimates, movement and harvest information was obtained from 168 recaptures. Age and growth, length-weight relationships and conditions factors were calculated. Preliminary information is also presented on maturation and fecundity. Extensive larval fish sampling by meter netting techniques were unsuccessful in capturing larval sturgeon, however, young measuring 1.8 inches were collected by other methods.

Keywords: Fish, Iowa, Harvest, Life history, Age and growth, Sturgeon

HELMS, D. R. 1973a. Progress report on the first year study of sub-legal sized channel catfish in the Mississippi River. Iowa cons. Comm., Fish. Sec., Ann. Prog. Rept. 2-178-R-1. Des Moines, IA. 57 pp.

Abstract: Sub-legal sized channel catfish populations in four pools of the Mississippi River were studied to determine the causes of variation in year class strength and develop a survey method which would predict potential and yield. Study pools were 9 near Lansing, 11 near Dubuque, 13 near Bellevue and 18 near Burlington. Fecundity of mature female catfish average 6,359 $\pm$ 1,483 eggs per lbs of body weight. No significant difference was shown between the pools. Spawning dates for 1972 were estimated by examination of catch statistics from commercial fishermen. Initial spawning temperature was 70 F or greater. Bait netting in the four pools showed catfish most important in the upstream pools. Tests of the effectiveness of cheese and soybean baits showed cheese produced largest catches in early spring and late fall; soybean bait was most effective during warmer months. Multiple regression analysis showed neither temperature or turbidity had significant influence upon the catch of catfish in baited hoop nets. Age and growth of channel

catfish indicated legal length was usually attained late in the second year oflife, and commercial exploitation resulted in cropping soon after the fish were legal sized. Small meshed seine hauls and otter trawl sampling techniques were used to assess year class abundance. Both methods indicated the 1972 year class of channel catfish was rather weak.

Keywords: Fish, Age and growth, Pools 9, 11, 13, and 18, Channel catfish, Sampling, Catfish

HELMS, D. R. 1973b. Progress report on the second year shovelnose sturgeon in the Mississippi River. Annual progress rept. for project 2-156-R-2. Iowa Cons. Comm. 33 pp.

Abstract: The second segment of the three year Federal Aid Project 2-156-R-2 was completed 30 June, 1973. The study was designed to investigate commercial shovelnose sturgeon harvest, study the life history and evaluate the present reporting system. Commercial harvest was low except during the final month of the period because of high water levels. As a result, only 879 fish were examined at commercial landings. Data were collected for age structure, size distribution and maturity of these fish. Fecundity was also determined. Additional samples totaling 843 fish were captured for tagging and determination of seasonal growth and sexual development. Age and growth, length-weight relationships, condition factors and other body measurements were calculated. Movement and growth increments were calculated from over 100 recaptured fish suring the second year of study. Expanded attempts using meter and frift nets were again unsuccessful in capturing larval sturgeon, but juvenile sturgeon appeared quite frequently in trawl samples.

Keywords: Fish, Population, Life history, Age and growth, Sturgeon

HELMS, D. R. 1974a. Progress report from the second year study of sub-legal sized channel catfish in the Mississippi River. Iowa Cons. Comm., Fish. Sec., Ann. Prog. Rept., 2-178-R-2. Des Moines, IA. 38 p.

Abstract: Investigations of sub-legal sized channel catfish populations in four navigation pools of the Mississippi River continued through the second year to determine causes of variation in year class strength and develop a survey method which would predict potential yield. Study pools were 9 near Lansing, 11 near Dubuque, 13

near Bellevue and 18 near Burlington. Fecundity of mature female catfish averaged 5,738 ± 2,169 eggs per lb of body weight. No significant difference was shown between the pools. Spawning dates in 1973 were estimated from catch statistics and occurred somewhat later than in 1972. Initial spawning was reported on 30 May and was most intense during 10-16 June. Bait netting in the four pools, like the previous year, resulted in greater channel catfish catches in pool 9 than in the downstream pools and higher catches of carp and drum in the downstream pools. Age distribution of bait net catches indicated an abundance of age III catfish, supporting earlier findings via 0-age seine haul surveys of a strong 1970 year class. Periods of greatest growth increments corresponded with high ponderal indices and occurred later in the year than in 1972. Total growth for the year was slightly less than the previous year and growth in pool 18 was below that found in other pools.

Keywords: Fish, Population, Age and growth, Channel catfish, Life history, Catfish

HELMS, D. R. 1974b. Age and Growth of Shovelnose Sturgeon, Scaphirynchus platorynchus (Rafinesque), in the Mississippi River. Iowa State Conservation Commission in Proceeding of Iowa Academy of Science, 81(2): 73-75.

Abstract: Anterior pectoral fin rays and body measurements were collected from 110 shovelnose sturgeon captured from October 29 through November 5, 1971, in Pool 13 of the Mississippi River. Fork length ranged from 7.4 to 23.7 inches and weight ranged from .06 to 2.02 lbs. The length-weight relationship was estimated as log W = 4.292 + 3.307 log FL with standard deviation for the regression coefficients plus or minus .046 and plus or minus .038, respectively. Condition factors (C) averaged 11.6 with a range from 9 to 17. Mean lengths at time of capture were 8.9, 13.7, 18.9 and 22.0 inches for age groups 0 through III.

Keywords: Fish, Pool 13, Production, Survey, Sturgeon, Age and growth, Condition

HELMS, D. R. 1974c. Shovelnose Sturgeon, Scaphirynchus platorynchus (Rafinesque), in the Navigational Impoundments of the Upper Mississippi River. Iowa Cons. Comm. 76 p.

Abstract: Shovelnose sturgeon are in high demand as a commercial food fish in the Upper Mississippi River area. Since little was known about harvest potential and suitability of existing regulations, investigations were conducted to survey commercial harvest; study life history of the species; and evaluate the present system for reporting catch statistics. Over 5,204 commercially harvested fish were examined and 4,056 were captured by experimental netting. Age and size distribution of commercial harvest, age and growth, length-weight relationships, maturity, fecundity, ration, movement, and population estimates were determined. Exploitation rates determined from tag returns varied from 1.2% to 42.9% in the various pools, but total annual mortality from age structure was estimated in nearly 60%.

Keywords: Impoundment, Fish, Non-game, Harvest, Survey, Life history, Production, Mortality, Age and growth, Sturgeon

HELMS, D. R. 1974d. Shovelnose sturgeon in the Mississippi River, Iowa. Technical series 74-3. Iowa Cons. Comm.

Abstract: Shovelnose sturgeon are in high demand as a commercial food fish in the Upper Mississippi River. Since little was known about harvest potential and suitability of existing regulations, investigations were conducted to survey commercial harvest, study life history of the species and evaluate the present system for reporting catch statistics. Over 5,204 commercially harvested fish were examined and 4,056 were captured by experimental netting. Age and size distribution of commercial harvest, age and growth, length-weight relationships, maturity, fecundity, ration, movement and population estimates were determined. Exploitation rates determined from tag returns varied from 1.2% to 42.9% in the various pools, but total annual mortality from age structure was estimated at nearly 60%. Although present harvest rates do not demand restricted harvests, a size limit may be justified on the basis of differential growth rate of immature vs. mature fish, market demand for large fish and greater weight loss among smaller fish during processing. Personal contacts with fishermen implementation of a revised system of collecting catch statistics requiring monthly reporting may have improved accuracy of catch statistics, but their reliability remains a chronic problem.

Keywords: Fish, Iowa, Population, Harvest, Life history, Sturgeon

HELMS, D. R. 1975a. Variations in the abundance of channel catfish year classes in the Upper Mississippi River and causative factors. Technical series No. 75-1. Iowa Cons. Comm.

Abstract: Vital statistics for channel catfish were described for Pools 9, 11, 13, and 18 in the Mississippi River to determine differences in year class abundance and causative factors. The 1970 year class was the most abundant. Very poor year classes occured in 1971 and 1972. The 1973 year class was slightly better than 1974. Year class abundance of channel catfish was established in the first year of life during spawning or hatching. No cause and effect relationship could be correlated with pesticides in eggs, ovarian parasites, fecundity or water level fluctuations. Spawning time and intensity was correlary to water temperature, but had no direct association to establishment of year class strength. Turbidity also influenced spawning, but was not adequately measured to determine its total effect. Factors that were suspected to be involved, but not evaluated in this study, were adult population density, abundance of predator and competitor species, food availability, and the quality of spawning habitat. More than a single factor obviously affects year class abundance. Trawling in the main channel of the stream during August was determined to be the most satisfactory method of surveying year class strength of 0-age channel catfish.

Keywords: Fish, Abundance, Age and growth, Pools 9, 11, 13, and 18, Catfish, Channel catfish, Habitat alteration

HELMS, D. R. 1975b. Variations in the Abundance of Channel Catfish Year Classes in the Upper Mississippi River and Causative Factors. Iowa Cons. Comm. Des Moines., IA. 39 p.

Abstract: Vital statistics for channel catfish were described for Pools 9, 11, 13, and 18 in the Mississippi River to determine differences in year class abundance and causative factors. Year class abundance of channel catfish was established in the first year of life during spawning or hatching. No cause and effect relationships could be correlated with pesticides in eggs, ovarian parasites, fecundity, water level fluctuation. Spawning time, and intensity was correlary to water temperature, but had no direct association to establishment of year class strength. Turbidity also influenced spawning, but was not adequately measured to determine its total effect.

Keywords: Upper Mississippi River, Iowa, Fish, Pools 9, 11, 13 and 18, Pesticides, Survey, Habitat alteration, Turbidity, Reproduction, Temperature, Catfish, Channel catfish

HELMS, D. R. and T. L. BOLAND. 1972. Upper Mississippi River Natural Resources Bibliography. Upper Mississippi River Conservation Committee, Fish Technical Section. Funded by U.S. Army Corps of Engineers and Iowa Conservation Commission. 62 p.

Abstract: References are given for 707 published and unpublished works pertaining to fisheries, game, law enforcement, pollution, recreation and miscellaneous natural resources of the Upper Mississippi River.

Keywords: Upper Mississippi River, Fish, Game, Pollution, Recreation, Regulations

HEMAN, M. L., R. S. CAMPBELL and L. C. REDMOND. 1969. Manipulation of fish populations through reservoir drawdown. Trans. Am. Fish. Soc., 98(2): 293-304.

Abstract: A summer drawdown was implemented on Little Dixie Lake, an 83 ha (205-acre) Central Missouri impoundment, to improve growth rate of largemouth bass and to re-establish populations of desirable size. Water level was lowered 2.4 m (8ft) between 19-29 July, 1964. Surface area was reduced by 42% and the volume by approximately 58%.

As a result of draining water from the bottom of this lake the hypolimnial waters were removed. Temperature gradient in the remaining eplimnial waters was broken and the lake became homothermos at 30 C (86 F).

Stomach analysis of largemouth bass indicated an increase in feeding activity following drawdown. Grams of food found in the stomach per 0.454 kg (1 lb) of bass was used as an index to feeding. These values increased from 4.0 g of food per 0.454 kg (1 lb) of fish prior to drawdown to 10.7 following drawdown. Per cent of empty stomachs also decreased during the post-drawdown period.

Scales collected from largemouth bass indicated an acceleration of growth in the year of drawdown, 1964. The increase in this increment of growth for 1964 over the previous year for age groups I, II, and III was

4.0, 4.0, and 3.3 cm (1.6, 1.6, 1.3 inches) respectively.

Harvest of bluegill increased immediately following the drawdown and declined during the succeeding two-month period. Largemouth bass harvest was reduced during August but there were increases in the numbers and average size of fish caught through September and October.

Shoreline seining before and after the drawdown indicated the density of fry and intermediate bluegill was reduced. It was thought the drawdown was responsible for a portion of this reduction through stranding of small sunfish in weed beds and shallow pools, through increased predation by bass on these small sunfish, and through exposure of nests as the water was lowered.

Keywords. Fish, Population, Reservoir, Drawdown

HEMMING, D. L. 1972. A distribution study of the mayflies, Hexagenia bilineata (Say) and Hexagenia hexagenia limbata (Serville) in the area of Lock and Dam 5A, Winona, Minnesota. M. S. Thesis (education), Winona State College, Winona, MN. 21 p.

Abstract: Both species' distributions were described. In the vicinity of Lock and Dam both species have same habitat requirements. There seems to be no depth preference. Gooch's method to distinguish between the two species was questioned. It was also pointed out that the Eckman wasn't a good sampler because it didn't go deep enough for the nymphs.

Keywords: Distribution, Invertebrates, Lock and Dam 5A, Mayflies

HENDRICKS, E. L. 1964. Compilation of records of surface waters of the United States, October 1950 to September 1960, Part 5, Hudson Bay and Upper Mississippi River Basins, WSP 1728. U.S. Geological Survey, Washington, D. C.

Abstract: This report is one of a series of 37 reports presenting records of stage and discharge of streams, and of stage and contents of lakes and reservoirs in the United States during the 1966-70 water-years; it contains the records for gaging stations and partial-

record stations in the Upper Mississippi River basin below Keokuk, Iowa.

Keywords: Hydrology, Upper Mississippi River

HERBICH, J. B. 1974. Proceedings of the dredging seminar (6th) held on January 25, 1974.

Abstract: Eight papers presented at the seminar cover the following topics: The 1973 Mississippi Flood and the Role of Hydraulic Dredging; Significance of Chemical Contaminants in Dredge Spoil; Systems Engineering and Dredging - The Feedback Problem; A Newcomer's Look at the Industry; Estuarine Impacts Related to Dredge Spoiling; Environmental Statement on Shell Dredging; and the Case for Dredge Specification Standards.

Keywords: Dredging, Toxicant, Spoil, Flood

HESSEL, R. 1878. The carp and its culture in rivers and lakes and its introduction in America. Rpt., U. S. Comm. of Fish. for 1875-1876, App. C, VII, pp. 865-899.

Abstract: The present article is intended to give a brief description of the well-known carp, its nature, way of living, its ratio of natural and artificial increase in open water, rivers and lakes, the most approved methods of its culture, and the proper construction of ponds and breeding establishments.

Keywords: Fish, Carp, Propagation

HESSELBERG, G. S. 1971. Sedimentation rates, particle size and distribution and sedimentation depths on Navigational Pool no. 7 including Lake Onalaska. M. S. Thesis, St. Mary's College, Winona, MN.

Abstract: Sedimentation rates of Pool 7 on the Mississippi River were found from 48-hour samplings using one-liter graduated Imhoff cones. Volumes were recorded in milliliters and some of the sediments were retained for partical size analysis. Pool and bottom sediment depths were recorded at each station.

The study grew out of a growing concern by sportsmen and residents of the area that Lake Onalaska (Pool 7) is threatened by siltation. Highest sedimentation rates were recorded near the small channels entering the

western part of Lake Onalaska from the Mississippi River channel and below the mouth of Halfway Creek on the east end. Very high rates were also recorded in the middle of the lake following severe weather with high winds. However, the data collected after high winds reveals a turnover of sediments, not direct sedimentation. The high rates in the channel are due to turnover caused by river traffic and the already present load of silt carried by the current which is dropped as waters are slowed by the dam. Bottom sediment core depths indicate the greatest siltation occurs near the small channels and around the mouth of Halfway Creek.

Nearly 80 percent of the sediments were clay and silt, with larger sand particles collected in a few areas.

Keywords: Sedimentation, Pool 7

HINE, R. L. 1973. Endangered animals in Wisconsin. Wisc. Dept. Nat. Res., Madison, WI. 27 p.

Abstract: A list of threatened and endangered birds, fish and mammals of Wisconsin with a description of where they are found and their life histories.

Keywords: Endangered species, Wisconsin

HINGTGEN, R. 1963. Commercial fish population trends as revealed in the statistics of the commercial fishery. Thesis. Loras College, Dubuque, Iowa. 51 pp.

Abstract: An attempt was made here to understand the dynamics of fish populations by studying trends in the commercial fishery. Results show that populations of the four main species of commercial fish seem to have increased in some cases and remained the same in others.

Keywords: Population, Commercial fishing

HOAR, M. A. and SR. C. MILLER. 1972. Midsummer studies of a new year round artificial substrate for macroinvertebrate populations in the Upper Mississippi River. M. S. Thesis, St. Mary's College, Winona, MN.

Abstract: In the midsummer of 1971, four graduate students undertook a project to determine the feasibility of using a new type of artifical substrate to obtain qualitative

and quantitative estimates of the macroinvertebrate population of the Upper Mississippi River. The researched area comprised seven miles of the Upper Mississippi River from Diamond Bluff, Wisconsin to Red Wing, Minnesota. This paper deals only with the downstream portion of the sector.

Samplers were used to collect organisms at three six-day intervals and one eighteen-day interval at various transects on the river.

Representatives of six phyla were found in the qualitative study whereas representatives of five phyla were found in the quantitive study. Totally ninety-two species were found. Thirty-four of these were common to both portions of the study. Differences were found in species diversity from transect to transect and from sector to sector. Transects with stable populations demonstrated high means and low coefficients of variation. Unstable populations showed low means and high coefficients of variation. The order Trichoptera was found in greatest abundance although Ephemeroptera and Diptera were also well represented.

Keywords: Invertebrates, Upper Mississippi River, Equipment

HOISETH, S. K. and R. E. MAYERCHAK. 1978. Physiologic studies on the heart of Amblema peruvian. Proc. Iowa Acad. Sci. 85(2): 70-73.

Abstract: The heart of the freshwater clam, Amblema peruviana was found to be relatively insensitive to changes in ionic concentrations, and could function in extremely dilute ionic environments. Pharmacologic studies showed a bimodal acetylcholine response, with inhibition at lower concentrations, and excitation at higher concentrations. Cl^- ion was found to potentiate the depressor acetylcholine response, with inhibition at lower concentrations, and excitation at higher concentrations. Cl^- ion was found to potentiate the depressor acetylcholine response. The resting membrane potential was found to be more negative than that found in comparable marine species.

Keywords: Physiology, Clams, Research

HOKANSON, K. E. F. 1968. The effects of synthetic detergents on the early life history of the bluegill (Lepomis macrochirus Rafinesque) in the Upper Mississippi River. Ph. D. Thesis, Univ. of Minnesota. 244 p.

Abstract: There was found no correlation between detergent concentrations and bluegill ecology. This was due primarily to the low levels of detergent during low flow periods prior to 1965. Continuing increasing populations also show there appears to be no effect. More subtle effects of synergism may be hard to uncover.

Keywords: Upper Mississippi River, Toxicant, Fish, Bluegill, Habitat alteration

HOKANSON, K. E. F.; L. L. SMITH, JR. 1971. Some factors influencing toxicity of linear alkylate sulfonate (LAS) to the bluegill. Trans. Am. Fish. Soc., 100(1): 1-12.

Abstract: Some factors influencing toxicity of linear alkylate sulfonate (LAS) on the early life history stages of the bluegill, Lepomis macrochirus (Rafinesque), were studied in raw Mississippi River water under ambient conditions and under controlled conditions in well water. Median response varied from 0.2-10 mg/l LAS with the life history phase and environmental conditions. Variation in estimation of TL_m values within and between similar tests was small in comparison to the influence of external factors.

The most important environmental factors related to lethal threshold concentration of LAS were dissolved oxygen, water hardness, and acclimation to LAS. High temperature decreased the median tolerance limit only during tests of short exposure. Sublethal concentrations of LAS increased toxicity of fuel oil mixtures while bentonite suspensions up to 200 mg/l had little influence on LAS toxicity. The most sensitive stage of development was the feeding sacfry, while the most tolerant stage was the newly hatched sac-fry. Eggs and fingerlings had similar intermediate tolerance limits. Egg fertilization was the least inhibited of the events studied. A concentration of 1 mg/l LAS is considered to be a first approximation of a safe concentration for bluegills in Mississippi River water of good quality.

Keywords: Fish, Toxicant, Pollution, Water quality

HOLT. C. S., R. SCHULTZ and C. HADLAND. 1971. Patterns of lakeshore use around Lake Bemidji. J. Minn. Acad. Sci. 37(2-3): 104-108.

Abstract: The eutrophication of lakes has been the subject of much discussion in scientific journals and the popular press. Usually the eutrophication process is accelerated by human activities. This study evaluates the extent of lakeshore development and recreational use of Lake Bemidji in north central Minnesota and examines the willingness of lakeshore residents to be assessed for corrective measures to halt deterioration of this valuable recreational lake. The shoreline of Lake Bemidji is highly developed, and the high density human habitation represents a potential source of nutrients from percolation through the sand and gravel soils which surround the lake. Residents around Lake Bemidji believe that growth of algae and aquatic vascular plants is not now severe and that it does not affect their use of the lake for recreational purposes. Although seventy-five percent of the residents favor regulation of lakeshore use and development, only 37 percent indicate willingness to be assessed for construction of a sewer line surrounding the lake.

Keywords: Recreation, Landuse, Minnesota

HOOPES, D. T. 1959. Utilization of mayflies and caddisflies by some Mississippi River fishes. Unpublished Masters Thesis. Iowa State University of Science and Technology. Ames, Ia.

Abstract: Large emergences of caddis and mayflies during the summer months create health, transportation, economic and nuisance problems in many populated areas adjacent to the impounded waters of the upper Mississippi River. A study of the biology of these insects and their value as a source of fish food was begun in 1957 to evaluate the possible effects of proposed insect control measures. This paper deals primarily with the utilization of mayflies and caddisflies as food by several species of fish in Pool 19 of the Mississippi River.

Keywords: Fish, Invertebrates, Food habits, Mayflies, Caddisflies

HOOPES, D. T. 1960. Utilization of mayflies and caddisflies by some Mississippi River fishes. Trans. Am. Fish. Soc. 89(1): 32-34.

Abstract: These nymphs are of known importance in the diets of Mississippi River fishes and birds. Mayflies comprised over 50 percent of the summer food of channel catfish, drum, mooneyes, goldeyes and white bass in the Upper Mississippi River.

Keywords: Invertebrates, Fish, Food habits, Mayflies, Caddisflies

HOPKINS, S. H. 1934. The parasite inducing pearl formation in American freshwater Unionidae. Science, N. S., (2052), 79: 385-386.

Abstract: In Illinois several species of clams are often heavily infested with encysted metacercariae which the author has identified as the larvae of Allocreadium ictaluri.

Keywords: Parasites, Mussels, Pearls

HOPWOOD, A. J. 1974. Thermal effects of nuclear power on the Mississippi River at Monticello, Minnesota. Water Resources Research Center, Univ. of Minnesota Graduate School. 131 p.

Abstract: The thermal effects of the nuclear power plant at Monticello, Minn., were assessed by comparing postoperational (1971-72) data to baseline data (1968-71) on the Mississippi River. Macroinvertebrate samples from artificial substrates placed upstream were compared with those from the heated zone downstream. Trichopteran biomass increased and ephemeropterans and dipterans decreased in the heated zone. Significant responses to heated water were observed from trichoptera from July-October, ephemeroptera were most affected from May-August, and dipterans declined significantly from September-November. The heat did not affect a number of species. Growth rates of macroinvertebrate groups in upstream and downstream areas were not significantly different in four of seven 35 day cycles observed. Black crappies, smallmouth bass, and walleyes were more numerous on the heated side.

Keywords: Minnesota, Thermal effluent, Pollution, Temperature, Nuclear power, Invertebrates, Fish, Biomass, Production

HORSELY, A. D. 1964. A geographic study of the socioeconomic factors in the middle Mississippi River Valley. M. A. Thesis, Dept. of Geography. Southern Ill. University.

Abstract: Patterns of well being are mapped and an effort is made to describe and establish them. A regional analysis is made of each type of well-being in an attempt to explain the pattern exhibited throughout the Middle Mississippi River Valley. The final statement in the thesis suggests that the valley has a variety of levels of well being somewhat intercorrelated.

Keywords: History, Geology, Urbanization

HOTTINGER, C. E. 1970. A study of the release of coliform organisms from benthic invertebrates to stream. M. S. Thesis, St. Mary's College, Winona, MN.

Abstract: The purpose of this study was to determine the significance of aquatic invertebrates as contributors of coliform organisms to a stream. Hesperophylax designatus was used as a representative of the aquatic invertebrates. The amounts of total coliform and fecal coliform bacteria given off by the organism was measured by the Millipore Filter Technique using MF-Endo Broth and M-FC Medium respectively for the total and fecal coliforms. Thirty tests of 24 hour duration were run with individuals in culture dishes.

Keywords: Bacteria, Invertebrates, Benthos

HOULIHAN, J. T., JR. 1968. The spring distribution and the coefficient of condition of game fish in Pool 6 of the Upper Mississippi River. B. A. Thesis, St. Mary's College, Winona, MN. 27 p.

Abstract: Specimens of five game fish-- the northern pike, largemouth bass, white bass, black crappie, and walleye pike-- were collected by an electro-shocking technique from Pool 6 of the Mississippi River in the spring of 1967. Their distribution was recorded and the coefficient of conditions or well being calculated. From this investigation it was found that each of the five types of fish caught inhabit a particular part of the river in the spring. The northern, largemouth bass, and crappie inhabit the backwaters while the walleye and white bass prefer a tailwater environment. Each of these fish had a coefficient of condition or well being index of at least good to average. Those of seemingly above average health were the northern, white bass, and largemouth bass, while the walleye and crappie held average ratings.

Keywords: Distribution, Fish, Pool 6, Upper Mississippi River, Condition

HOWARD, A. D. 1914. Experiments in propagation of freshwater mussels of the Quadrula group. App. 4, Rep. U. S. Comm. Fish., 1913 (Doc. No. 801). 52 p.

Abstract: Fish were sampled at large and studied for natural infections and examined for glochidia to determine natural hosts. Artificial infections were then made on the natural hosts for mussels of the Quadrula group.

Keywords: Mussels, Research, Propagation, Fish

HOWARD, A. D. 1922. Experiments in the culture of fresh-water mussels. Bull. U.S. Bur. Fish. 38: 1-89.

Abstract: This method briefly, is the infection of suitable fish with the young mussels in the parasitic stage. These fish are then released to spread the mussels at large under natural conditions.

KEYWORDS: Mussels, Research, Propagation, Fish

HOWE, H. V. and W. A. VAN DEN BOLD. 1975. Mudlump Ostracoda. Bull. Am. Paleontol. 65:282.

Abstract: Mudlumps are intrusive clays that have pentetrated into and through bar deposits near the mouths of Mississippi River passes. They may occur above or below sea level and about a hundred of them have been mapped. Radiocarbon date on Foraminifera from these deposits is 15,000 years before present, on macrofossils 15,500 years. Ostracoda are listed from three of the mudlumps. Each of the three samples contained more than 50 species, which is well above the number found in any Recent samples from the Gulf of Mexico. The Ostracoda are very well preserved and their distribution suggests deposition at a depth of approximately 100 feet. No formal descriptions are given, but SEM photographs are shown for all but the rarest species. Several species indicated in the list as new have been described erroneously under different names by previous workers.

Keywords: Benthos

HOWE, R. S. and A. H. J. DORCEY. 1973. Regional Water Quality Management: A case study of the Wisconsin River. AICHE Symposium Series. 69(129): 371-379.

Abstract: This paper summarizes the results designed to provide a deeper understanding of the relationships among the physical potentials for managing water quality, the costs of achieving specified patterns of quality, and the institutional arrangements that might be adopted to implement regional water quality program.

Keywords: Water quality

HUBBS, C. L. 1951. Notropis amnis, a new cyprinid fish of the Mississippi fauna, with two subspecies. Occ. Pap. Mus. Zool. Mich., 530: 1-30.

Abstract: Recent exploration of the rich cyprinid fish fauna of eastern North America, accelerating through the past quarter century, has revealed and is continuing to reveal new species referable to the dominant genus Notropis. One of these is a small species that has been called Notropis amnis, though it has never been assigned an available name. It is the purpose of this paper to propose this name formally, to diagnose the 2 subspecies into which it is divisible, to summarize and clarify their confused nomenclatorial history, to discuss their intergradation, and to map and interpret their geographical distribution.

Keywords: Fish, Rare species

HUBLEY, R. C., JR. 1959-1961. Annual reports, Mississippi River commercial fishing statistics, Wisc. Cons. Dept., Fish Manage. Div. Mimeo., unpublished.

Abstract: A series of annual reports of commercial fishing which describes in tables the total catch in pounds by species and approximate value of catch by species, total catch by gear, number of commerical fishermen and amount of gear licensed, and a monthly summary of gear types used per pool.

Keywords. Commercial fishing, Statistics, Harvest

HUBLEY, R. C., JR. 1961a. Harvest and movement of channel catfish in the Upper Mississippi River. Wisc. Cons. Dept., West Central Area, invest. Memo., No. 12. Unpublished. 11 p.

Abstract: The catfish fishery is one of the most valuable commercial fisheries of the Upper Mississippi River.

Although three species of catfish are known to occur, only the channel catfish (Ictalurus punctatus) and the flathead catfish (Pylodictis olivaris) support the fishery in the upper reaches. The once-common blue catfish (Ictalurus furcatus) is taken very infrequently.

Information necessary for the proper management of the catfish fishery is incomplete. A tagging study was initiated in 1947, to determine the harvest, movements and possible homing tendencies of the channel catfish, as a basis for better understanding this species.

Keywords: Harvest, Fish, Upper Mississippi River, Movement, Catfish, Channel catfish

HUBLEY, R. C., JR. 1961b. Mississippi River electrofishing survey in Pools 6, 7, and 8 during 1960. Wisc. Cons. Dept., West Central Area, Invest. Memo. No. 13. Mimeo., unpublished. 22 p.

Abstract: In 1960, an electro-fishing survey was conducted which also involved the use of many kind of nets as fish collection gear. The objectives of the 1960 survey were to obtain fish population structure and distribution data and to investigate areas that could be considered likely permanent sampling stations for future survey work.

Keywords: Survey, Fishing, Pools 6-8

HUBLEY, R. C., JR. 1961c. Experimental trawling on Lake Pepin. Wisc. Cons. Dept., West Central Area, Invest. Memo. No. 14. Mimeo., unpublished. 7 p.

Abstract: In 1960 the otter trawl was used experimentally to test its efficiency as a fish collecting device in Lake Pepin. Similar trawling was done in Pool 8 of the Mississippi River in 1958, 1959, and 1960, and in Pool 7 in 1960. It was concluded from the latter studies that the otter trawl is not an efficient fish collecting device for use in the main channel of the Mississippi River.

Keywords: Fishing, Lake Pepin

HUBLEY, R. C., JR. 1961d. Mississippi River Electrofishing Survey in Pools 9, 10, 11 and 12 during 1961. Wis. Cons. Dept., Fish Manage. Div., West Central Area, Invest. Memo. No. 15, Mimeo., unpublished, 39 p.

Abstract: In 1961, an electrofishing survey was conducted in Pools 9, 10, 11, and the upper Mississippi River. In 1960, a similar survey was conducted in Pools 6, 7 and 8. The objectives of the survey were to obtain fish population structure and distribution data and to investigate areas that could be established as permanent sampling stations for future survey work.

Keywords: Fish, Pools 9-12, Population, Distribution, Survey

HUBLEY, R. C., JR. 1961e. Incidence of lamprey scarring of fish in the Upper Mississippi River, 1956-58. Trans. Am. Fish. Soc., 90(1): 83-85.

Abstract: The findings summarized here lead to the conclusion that the parasitic fresh-water species of lampreys are not detrimental to the fish populations of the upper Mississippi River. The incidence of lamprey scarring on fish captured during the surveys was insignificant.

Keywords: Parasites, Fish, Upper Mississippi River, Lamprey

HUBLEY, R. C., JR. 1963a. The second year of walleye and sauger tagging on the Upper Mississippi River. Wisc. Cons. Dept., West Central Area, Invest. Memo. No. 16. Mimeo., unpublished. 4 p.

Abstract: The walleye and the sauger constitute an important and integral part of the upper Mississippi River sport fishery. In the spring of 1959, a two-year walleye and sauger tagging project was completed by the Wisconsin Conservation Department. The objectives of the project were to determine (1) the extent of movement, if any, of walleyes and saugers between pools, since management of separate populations in each pool might be feasible if such information is known and (2) the degree of exploitation of this particular segment of the sport fishery.

Keywords: Fish, Survey, Upper Mississippi River, Walleye, Sauger

HUBLEY, R. C., JR. 1963b. Movement of tagged channel catfish in the Upper Mississippi River. Trans. Am. Fish. Soc. 92: 165-170.

Abstract: Ictalurus punctatus were tagged from summer 1947 through February 1950. Groups of tagged fish were released from five sites from Gay City, Wisconsin to Lansing, Iowa. This was to study nature of channel catfish's movements and any possible homing tendencies.

Keywords: Fish, Movement, Upper Mississippi River, Catfish, Channel catfish

HUBLEY, R. C., JR. and J. G. BRASCH. 1959. First progress report of the effects of commercial gill netting and seining upon spring populations of game fish and migratory waterfowl on the Upper Mississippi River. Wisc. Cons. Dept., West Central Area, Invest. Memo No. 3.

Abstract: For several years, there has been a question as to whether or not commercial gill netting, and to a lesser degree seining, in spring is detrimental to spawning game fish and migrating waterfowl on the upper Mississippi River. In order to answer the question and to provide a basis for different regulations, if such are necessary, information on the relative catches of commercial fish and game fish and waterfowl taken accidentally, was needed. To provide this, a program of checking and reporting gill net and seine catches was undertaken.

Keywords: Commercial fishing, Waterfowl, Research

HUBLEY, R. C., JR. and J. G. BRASCH. 1960. Concentrations of fisherman on the Mississippi River as determined by aerial census. Wisc. Cons. Dept., West Central Area, Invest. Memo. No. 10. Mimeo., unpublished, 23 p.

Abstract: In an effort to define sport-fishing concentrations on the Mississippi River, an aerial census of anglers was conducted intermittantly from January 19, 1957, to January 18, 1958. Knowledge of fishing concentrations would be very useful in planning public access programs creel census studies, and determining general river usage by fishermen.

During the winter flights, ice fishermen, boat fishermen, fishing houses, and cars were counted and the exact

location of each recorded on a map. During the summer flights, barge fishermen, bank fishermen, fishing boats, and pleasure boats were counted and located on maps in a similar manner.

Keywords: Creel census

HUBLEY, R. C., JR., and W. B. FERNHOLZ. 1960. Fishing the Mississippi. Wisc. Conserv. Bull. 25(7): 1-4.

Abstract: With its deep-water channels, its chutes, connecting sloughs, and backwater lakes, its side channels, sand bars, and eddying currents, the Mississippi river furnishes some of Wisconsin's finest fishing. This variable habitat lends itself well to the seemingly endless variety of fish inhabiting the river and maked the Mississippi the larges "fish hatchery" in the country. Bluegills, walleyes, sauger, crappies, northern pike, and bass are common fish caught in the Mississippi.

Keywords: Fishing

HUBLEY, R. C., JR. and A. H. FINKE. 1963. Mississippi River electrofishing survey in Pools 4, 5, 5A, and 6 during 1962. Wisc. Cons. Dept., West Central Area, Invest. Memo. No. 17. Mimeo., unpublished. 29 p.

Abstract: In 1962, an electrofishing survey was conducted in Pools 4, 5, 5A and 6 of the Mississippi River. Similar surveys were conducted in Pools 9, 10, 11 and 12 in 1961 and in Pools, 6, 7, and 8 in 1960. The objectives of the survey were to determine fish population structure and distribution and to investigate areas that could be considered permanent sampling stations for future survey work.

Keywords: Fishing, Pools 4, 5, 5A and 6

HUBLEY, R. C., JR. and G. D. JERGENS. 1959. Walleye and sauger tagging investigations on the Upper Mississippi River. Wisc. Cons. Dept., West Central Area, Invest. Memo. No. 1. Mimeo., unpublished. 9 p.

Abstract: The walleye and the sauger constitute an important and integral part of the upper Mississippi River sport fishery. In the spring of 1958 a two-year walleye and sauger tagging project was initiated by the Wisconsin

Conservation Department. The objectives of this project were to determine (1) the extent of movement, if any, of walleyes and saugers between pools, since management of separate populations in each pool might be feasible if such information is known and (2) the degree of exploitation of this particular segment of the sport fishery.

Keywords: Fish, Upper Mississippi River, Walleye, Sauger

HUBLEY, R. C., JR. and G. D. JERGENS. 1960. Creel census on the Upper Mississippi River, 1957-1958. Wisc. Cons. Dept., West Central Area, Invest. Memo. No. 8. Mimeo., unpublished. 52 p.

Abstract: Certain basic information was desired for the mutual benefit of the members of the UMRCC. This information was collected on a pool basis by one full-time creel census clerk and included the (1) number of fishermen interviewed, (2) number of each species in the catch, (3) number of hours fished, (4) catch per unit of effort and (5) specific nature was also collected to determine the influence of certain factors upon fishing success.

Keywords: Creel census, Upper Mississippi River

HUGGINS, T. G. and R. W. BACHMANN. 1969. Production of channel catfish (Ictalurus punctatus) in tertiary treatment ponds. Iowa State University, Ames, Iowa State Water Resources Research Institue, Completion Report. 119 p.

Abstract: A series of four tertiary treatment ponds were constructed and data were collected on these ponds from June 1967 to September 1968. The objectives of the study were: 1) To see if fish could live and grow in these ponds, 2) To determine the potential production of fish in these ponds, 3) To describe the physical, chemical and biological features of these ponds.

Keywords: Channel catfish, Catfish

HUNN, J. B. 1972. Blood chemistry values for some fishes of the Upper Mississippi River. J. Minn. Acad. Sci. 38(1): 19-21.

Abstract: Plasma concentrations of sodium, potassium, calcium, magnesium, chloride, inorganic phosphate, glucose, lactic acid and total carbon dioxide and whole blood pH and hematocrit were determined for nine species of fish from the Upper Mississippi River area. Most of the values obtained fall within the range of values published for other freshwater fishes, except that the plasma concentrations of potassium and chloride in sexually mature walleye pike were low. The chloride was compensated for by a high plasma total carbon dioxide. Further studies should establish whether these blood chemistry values may be considered of normal range.

Keywords: Fish, Upper Mississippi River, Chemistry, Research

HUS, H. T. A. 1908. An ecological cross section of the Mississippi River in the region of St. Louis, Missouri. Ph. D. Thesis, Washington Univ., St. Louis, MO.

Abstract: In the following paper an attempt has been made to analyze the physiographic features of the river valley and to study the distribution of the local flora with reference to them.

Keywords: Missouri, Ecology

JAIN, S. C., W. W. SAYRE, Y. A. AKEAMPONG, D. McDOUGALL, and J. F. KENNEDY. 1971. Model studies and design of thermal outfall structures Quad-Cities Nuclear Plant. Univ. of Iowa Inst. of Hydraulic Research, Iowa City, IA. 106 p.

Abstract: The present investigation was concerned with the thermal-hydraulic design of the outfall structure for the condenser-water discharge from the two 888 Mw units of the Quad-Cities Nuclear Power Plant, located on the east bank of the Mississippi River. Steam condensation for the plant will be achieved by means of 2270 cfs of cooling water that is diverted from the Mississippi River, passed through the condensers, and returned to the river at a temperature 23 F above ambient.

Keywords: Thermal effluent, Discharge, Nuclear power, Models

JAKLE, J. 1963. Transportation and the evolution of river settlement along the middle Mississippi River. M. A. Thesis, Dept. of Geography, Southern Ill. University.

Abstract: The development of river settlements was detailed in terms of focus, river orientation, street patterning and shape or outline of respective settlements. Each characteristic was described at specific settlement sites, some principles of growth and/or decay of specific forms postulated in general terms.

Keywords: Geology, Urbanization, History

JAMES, J. E. 1966. Biology of the soft-shelled turtle, Trionyx, sp., of the Upper Mississippi River. M. S. Thesis (education), Winona State College, Winona, MN. 29 p.

Abstract: Trionyx sp. prefers permanent bodies of water large enough to have a slight current, good swimmers, and or muddy bottoms with sandy beaches. The predators are man who eat turtles, and skunks, raccoons, fox and crows who eat the eggs.

Keywords: Upper Mississippi River, Reptiles, Life history, Research, Survey, Turtles

JASKE, R. T. 1972. A future for one-through cooling. Power Engineering 76(1): 44-47.

Abstract: Waste heat is the ultimate residual of all society's activities and cannot be abated as a common pollutant.

Once-through cooling and the enormous dissipative capacities of receiving waters can be used to transfer much of the waste heat from power stations to the air for decades to come.

Keywords: Thermal effluent, Discharge, Nuclear power

JENKINS, R. M. 1972. Estimation of fish standing crop, sport fish harvest and angler use for the planned Smithville and Union reservoirs, Missouri and LaFarge Reservoir, Wisconsin. N. S. Fish and Wildlife Service, Washington D. C. unpublished.

Abstract: The popularity of the reservoirs for sport fishing and the standing crop of sport fish in each reservoir was assessed in this paper.

Keywords: Missouri, Wisconsin, Fish, Standing crop, Sport fishing, Reservoir, Angling

JERGENS, G. D. 1957-1958. Annual reports, Mississippi River commercial fishing statistics. Wis. Cons. Dept. Mimeo., unpublished.

Abstract: These commercial fishing statistics are compiled annually from information received from commercial fishermen required to submit catch reports monthly. Each fisherman must file a report with the La Crosse office stating the pool fished, kinds of gear used, the amount and species of fish taken, and other pertinent information relative to his operation.

Keywords: Commercial fishing, Statistics, Harvest

JERGENS, G. D. 1958. Name it - you can have it. Wis. Cons. Bull. 9:22-26.

Abstract: The Mississippi has a huge variety of fish in its 176,000 acres bordering Wisconsin. Almost every species of freshwater game or sport fish can be caught there.

Keywords: Fish, Fishing

JERGENS, G. D. 1959. Mississippi River test netting and electrofishing survey, Wisconsin stations, 1958, Pools 6 and 7. Wis. Cons. Dept., W. C. Area, Invest. Memo. No. 4. Mimeo., unpublished. 25 p.

Abstract: In 1956 and 1957, the states of Wisconsin and Iowa conducted a cooperative survey in Pools 8 to 11. In 1958, the state of Wisconsin completed the segment consisting of Pool 6 and the upper portion of Pool 7. The state of Minnesota meanwhile surveyed Pools 3 through 5A.

The 1958 survey was conducted to obtain data essentially comparable to that collected in the two prior years in the other pools. Basically, it was an effort to obtain population structure data as shown by relative numbers and weights of fish taken per comparable unit of effort, length-frequency distribution of game fish species, and age and growth analyses. Other comparable data such as lamprey scarring incidence and environmental factors affecting population structure were also collected.

This report is limited to the presentation and analysis of catch data including length frequency distribution of sport fish and the incidence of lamprey scars on fish captured. Also included is an evaluation of the boom shocker as a sampling device.

Keywords: Survey, Fishing, Pools 6 and 7, Wisconsin

JERGENS, G. D. 1965. Length-frequency distribution of adult mayflies (Hexagenia) as evidence of a summer generation on the Upper Mississippi River. M. S. Thesis (education), Winona State College, Winona, MN. 30 p.

Abstract: Summer generations of Hexagenia sp. do exist in the Mississippi River as found by other authors in other waters. It was established as possible in the laboratory and now found true in nature.

Keywords: Invertebrates, Distribution, Upper Mississippi River, Mayflies, Life history

JESSEN, R. L. 1970. Mallard population trends and hunting losses in Minnesota. J. Wildl. Manage. 34(1): 93-105.

Abstract: The abundance of the mallard (Anas platyrhynchos) as a breeding duck in Minnesota is known only from general reports until about 20 years ago when systematic censuses began. Records suggest an early decline in abundance prior to 1900. More recently, there has been a slight increase to a level of approximately one pair per square mile in the ten better duck-breeding counties of the western and northcentral portion of the

state. During the 1950's, the first-year total mortality of wild young mallards reared in the state was high (75-85 percent). Most of this mortality was from hunting (55-65 percent) and about 70 percent of this was reported from Minnesota. Mallard reproductive success in the state is considered average, or better than average, compared with other breeding localities, but statistics and hunting regulations clearly indicates that in years of highly restrictive regulations, especially those having a daily limit of one mallard, there has been a reduction in the harvest of local mallards and increased survival of local birds. Within large refuge units survival and subsequent production of mallards has been higher than in a non-refuge areas of Minnesota. There is a conflict between maximum sport-hunting use of of wetlands and maximum production of mallards. It is suggested that this conflict can be resolved in part by setting aside a portion of the state wetlands in a pattern of small refuges. Additional protection thus gained locally in Minnesota, together with judicious hunting regulations throughout the Flyway, can increase the breeding population and harvestable surplus of mallards.

Keywords: Ducks, Hunting, Population, Minnesota, Mallard

JOHNSON, B. H. 1974. Unsteady Flow Computation on the Ohio-Cumberland-Tennessee-Mississippi River System. Army Engineer Waterways Experiment Station Vicksburg, Miss. 47 p.

Abstract: The U. S. Army Engineer division, Ohio River, directs the operation of Barkley and Kentucky Reservoirs on the Cumberland and Tennessee Rivers, respectively, during periods of flooding on the lower Ohio and lower Mississippi Rivers. Flood control regulation by these reservoirs is met by controlling, to some degree, the Ohio River stage at Cairo, Illinois. A mathematical model, SOCHMJ, capable of accurately predicting Ohio River stages as a result of reservoir operations at Barkley and Kentucky Reservoirs has been developed. SOCHMJ provides the capability of modeling a system containing an unlimited number of junctions. The physical limits of the Ohio-Cumberland-Tennessee-Mississippi system modeled herein are Golconda, IL, on the Ohio river; Barkley Dam on the Cumberland River; Kentucky Dam on the Tennessee River; Cape Girardeau on the Upper Mississippi River; and Caruthersville on the Lower Mississippi River.

Keywords: Reservoir, Flood, Dam, Flow

JOHNSON, C. 1976. Wetland use in Wisconsin: historical perspective and present picture. Wis. Dept. Nat. Res. publication.

Abstract: This study is one of a series of reports written for the Statewide Water Resources Management Plan, "Visions of Tomorrow"

Phase One of the plan was published in 1973 and is available from the Department of Natural Resources upon request. It is anticipated that over the coming years more phases will be published.

The purposes of the plan are: (1) to describe alternatives, (2) to examine the trade-offs associated with each, (3) to solicit people's preferences with respect to the alternatives, (4) to present this information to decision makers, and (5) to publish these choices, which in effect becomes the plan.

This publication is an historical analysis of wetlands in Wisconsin. Its purpose is to provide background information for later consideration of alternative futures, policies and regulations for the use of the state's wetlands. The report focuses on the history of wetlands use in Wisconsin. More detailed sources on such topics as the biology and hydrology of wetlands are included in the bibliography. Other reports will be published later on present policies and regulations affecting wetlands and alternatives for future policies and regulations.

Keywords: Wisconsin, History, Wetlands

JOHNSON, F. H. and M. W. JOHNSON. 1971. Characteristics of the 1957-58 and 1939 sport fishery of Lake Winnibigoshish and connecting waters with special emphasis on the walleye population and catch. Minn. Dept. Nat. Res. Investigational. Rept. No. 312.

Abstract: Estimated total summer fishing pressure was 443,370 man hours, or 6.0 man hours per acre in 1957, and 541,005 man hours or 7.3 man hours per acre in 1958. Winter fishing was 8% of the year's total in 1957 and 6% in 1958. Walleye and northern pike were principal species in the catch, each representing 46% of yield by weight.

Most of the walleye catch was made up of age classes III through VI. Average length was 15.6 inches and average weight was 1.4 pounds. The walleye catch was highest in the spring, declined in midsummer, and increased in the fall. Northern pike were important as alternative species when walleye catch was low.

Comparison of catch statistics for 1939 and 1958-1959 reveal an increase by about 5 times in man hours of fishing. Total walleye yield by number doubled but catch rate dropped by one-half. Average weight of walleye in catch was 2.2 pounds in 1939.

Partial homing tendence by walleye for particular spawning grounds was observed. This tendency was stronger for females than for males.

The average annual total mortality rate for walleye age IV and over was 44% with an exploitation rate of 11% for 1957, and 22% for 1958.

Keywords: Minnesota, Sport fishing, Population, Fish, Distribution

JOHNSON J. H. 1976a. Effects of Two Traffic on the Resuspension of sediments and on Dissolved Oxygen Concentrations in the Illinois and Upper Mississippi Rivers under Normal Pool Conditions. Army Engineer Waterways Experiment Station Vicksburg, Mississippi. 185 p.

Abstract: This study was conducted to determine the effects of single and multiple tow traffic on the resuspension of reversed sediments and on dissolved oxygen concentrations at several locations on the Illinois and Upper Mississippi Rivers during normal pool conditions. In total, 19 separate tows were monitored on the Mississippi River and 21 towns on the Illinois River at locations chosen to correspond to upper, middle, and lower river reaches. Composite water-column samples were collected simultaneously at each sampling station at sellected time intervals. Current velocity profiles, water depth, water temperature, and river stage were also measured. Dissolved oxygen measurements were made in situ at surface, mid-depth, and near-bottom strata in the main channel only. These analyses indicated that tow traffic on the Illinois and Upper Mississippi Rivers during normal pool conditions does contribute to existing levels of suspended sediment measured as both suspended solids and turbidity, and, furthermore, that sediments resuspended from the main channel do more

laterally to shoreward areas, including potentially productive side channel areas. Based on the relative responses of suspended solids concentrations and turbidity levels following the passage of tow traffic on both the Illinois and Upper Mississippi Rivers, the Illinois River appears to be more susceptible to tow traffic effects than the Mississippi River. It was also shown that in most cases tow traffic did not reduce dissolved oxygen concentrations in the water column of the main channel of either river.

Keywords: Tow, Commercial boat traffic, Sediment, Illinois River, Upper Mississippi River, Turbidity, Pollution

JOHNSON, J. H. 1976b. Feasibility of Using Historic Disposal Areas, Upper Mississippi River, to Evaluate Effects of Dredged Material Disposal on Community Structure of Benthic Organisms. Army Engineering Waterways Experiment Station Vicksburg, Miss. 90 p.

Abstract: Environmental studies addressing the effects of dredged material disposal on the community structure of benthic organisms in freshwater systems are extremely scarce. Most studies of this general nature have been conducted in marine environments and have emphasized short-term effects, rather than long-term effects. The community structure of benthic organisms occurring in four historic disposal areas (1969, 1972, 1973, 1974), Pool 25, Mississippi River, was investigated in June 1974 to determine if these areas, with known disposal histories, could be evaluated in terms of effects related to the disposal of dredging material. Concurrently, unaffected control areas were also studied to differentiate between effects related to disposal activities and those associated with natural changes. The community structure of benthic organisms was described in terms of numerical abundance, biomass, species diversity, and evenness indices. Substrate types and water depths were also described for each sampling area.

Keywords: Upper Mississippi River, Benthos, Dredging, Sediment

JOHNSON, J H., R. C. SOLOMON, C. R. BINGHAM, B. K. COLBERT, and W. P. EMGE. 1974. Environmental Analysis and Assessment of the Mississippi River 9-ft. Channel Project Between St. Louis, Missouri, and Cairo, Illinois. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 148 p.

Abstract: This project was authorized by the River and Harbor Acts of 1927 and 1930, for the purpose of obtaining and maintaining a 9- and 300-ft. channel for navigation from the confluence of the Missouri River (St. Louis, Mo.) to the confluence of the Ohio River (Cairo, Ill.). The main channel will be contracted to 1500 ft. between riverward ends of dikes throughout the study area in order to maintain the 9-ft. depth during periods of low flow. A comprehensive study of the historical geomorphology supplemented by physical models of the river and side channels was made to determine the physical impact of river contraction works on river morphology and behavior. An intensive study of the terrestrial flora and fauna was also conducted to inventory the existing organisms and communities located in the unprotected floodplain and to assess the impacts of operation and maintenance activities on the organisms and communities. In addition, the aquatic flora and fauna were studied to inventory the aquatic communities in the study and to assess the importance of side channels to the riverine ecosystem.

Keywords: Missouri River, Ohio River, Missouri, Illinois, Navigation, Channelization, Habitat alteration

JOHNSON, L. G. 1966. Pesticide concentration levels in Iowa fish. Iowa Cons. Comm., Quart. Biol. Repts., 18(4): 19-23.

Abstract: Fish fillets collected from the Mississippi River were examined for pesticide residues. Three walleyes from Pool 11 did not exceed 0.1 ppb.

Keywords: Pool 11, Pesticides, Iowa, Fish

JOHNSON, L. G. and R. L. MORRIS. 1974. Chlorinated insecticide residues in the eggs of some freshwater fish. Bull. Environ. Contam. Toxicol. 11(6): 503-510.

Abstract: Routine monitoring of the pesticide concentrations in a number of Iowa rivers over a period of years indicated that chlorinated hydrocarbon insecticides, used in row crop agriculture, were being carried into the rivers by soil erosion and being found in fish eggs.

Keywords: Chlorinated hydrocarbons, Fish, Reservoir, Iowa

JOHNSON M. S. and F. MUNGER. 1930. Observations on excessive abundance of the midge Chironomus plumosus at Lake Pepin. Ecology 11: 110-126.

Abstract: A feature of this study was the number of chironomid larvae found. The study was directed not to a discovery of control measures, but to a better understanding of the life history and ecological relationships of the midges.

Keywords: Lake Pepin, Invertebrates, Benthos, Midges, Abundance

JOHNSON, R. L. 1968. River rafting in Wisconsin from the 1840's - 1880's. Research paper presented to Graduate Faculty. Winona State College, Winona, MN.

Abstract: For almost forty years, the rivers provided the Wisconsin lumber industry with cheap transportation. Rivers like the Wisconsin were never efficient, never dependable and always dangerous. Rafting, further, severely limited the lumbermen to selling only water-soaked and muddied rough-sawed boards to St. Louis and other Missippi River ports. The railroads that replaced rafting were able to solve most of the lumbermen's transportation problems, and they opened new markets by making it possible to ship the more profitable finished wood products without damage. They also took the risk out of transportation, and they did the job faster. By 1883, the lumber industry was pressing on to bigger things, pausing, hardly at all, to mourn the passing of river rafting, one of Wisconsin's most exciting areas.

Keywords: Wisconsin, Recreation

JOHNSON, R. P. 1963. Studies on the life history and ecology of the bigmouth buffalo, Ictioluis cyprinellus (Valenciennes). J. Fish. Res. Board Can. 20:1397-1492.

Abstract: The field study of the bigmouth buffalo (Ictiobus cyprinellus (Valenciennes)), conducted mainly in 1955 and 1956, was concentrated on two small eutrophic lakes in the Qu'Appelle River drainage of Saskatchewan. The bigmouth buffalo reaches its northern limit of range in the Qu'Appelle drainage. Migration into Saskatchewan was probably through postglacial connections at the headwaters of the Mississippi and Red River systems. In the lakes studied, the species prefers water shallower than 5 m.

The relation of standard length to fork length and of fork length to weight is presented graphically, and the latter described by an equation. Length-frequency distributions and age determinations from scale reading

show that the population studied was largely the very successful 1948 year-class, produced in a year of extensive flooding. Annulus formation occurred during the second or third week in June. Growth of the 1948 year-class in Pasqua Lake was extremely slow, probably influenced by the cool climate and population density here.

Food of young buffaloes was mainly Cladocera and Copepoda. Larger buffaloes ate about 75% Entomostraca and 15% chironomids, the latter more important as the size of fish increased. Analysis of the living habits of the food eaten, and the feeding mechanism of the buffalo, shows that they occupy a food niche overlapping both bottom feeders and limnetic plankton feeders.

Sexual maturation, expecially of females, was extremely slow both in age and size as compared with southern populations. Examination of gonads suggests spawning occurs about May 18-25. Egg measurements indicate that females do not all spawn each year. The contention by other investigators that spawning is "triggered" by addition of fresh water analogous to normal spring floods of the Mississippi River is supported by the present study.

The population in the Qu'Appelle drainage is probably dependent on the very sporadic production of strong year-classes. A more stable population would require association with regular spring floods of a nearby river or marsh. Commercial removal from the viewpoint of greatest productivity is most economical at the smallest marketable size, as yearly weight gains are probably more than offset by natural mortality.

Keywords: Ecology, Life history, Fish, Age and growth, Research, Buffalo fish

JONES, J. R. 1975. Water Quality in Iowa Streams. Summary of a Conference Held March 1975. Iowa State Water Resources Research Inst., Ames Office of Water Research and Technology, Washington, D.C. 93 p.

Abstract: On March 4, 1975, a conference on water quality in Iowa streams was held on the Iowa State University campus. This three-part publication is intended to serve as a summary of the conference and to document available past and current work in Iowa streams. Part I contains titles and abstracts of the talks given at the conference. Part II is a bibliography of papers and reports dealing with

stream water quality in specific Iowa streams. Information regarding study reach, sampling schedules, parameters measured, methods of analyses, and data availability are given in alphabetical order by stream. The last two sections are based in part on questionnaires distributed to various investigators prior to and during the conference.

Keywords: Water quality, Iowa, Pollution, Ecology, Phytoplankton, Periphyton, Invertebrates, Turbidity, Temperature

JONES, R. O. 1950. Propagation of freshwater mussels. Prog. Fish-Cult., 12(1): 13.

Abstract: In the late 1800's it was discovered that fresh-water mussel shells could be used as buttons. A great industry developed around the mussels in the upper Mississippi River and its tributaries. Intensive harvesting of mussels caused fear that a natural resource would be depleted and in 1894 the U.S. Bureau of Fisheries became involved. Through efforts to propagate at the newly opened Fairport Biological Station we now have the first complete picture of the life history of freshwater mussels. Techniques of handling, collection, and propagation are discussed and pictures presented. Sketches and discussion of the life history are included.

Keywords: Mussels, Benthos, Propagation

JORDAN, D. S. 1907. Fishes. Henry Hold & Company, New York. 789 pp.

Abstract: This work contains virtually all the non-technical material contained in the author's "Guide to the Study of Fishes." It lacks the considerable portion relating to the structure and classification of fishes, which is intended rather for the technical student of ichthyology.

The present volume contains substantially all which the author would have written had his original purpose been to cover the subject of fishes in a general natural history of animals. The fishes used as food and those sought by anglers in America are treated fully, and proportionate attention is paid to all the existing as well as all extinct families of fishes.

Keywords: Fish

JORDAN, D. S. and B. W. EVERMANN. 1896. The fishes of North and Middle America. U.S. Nat. Hist. Mus. Bull. 47. 1240 pp.

Abstract: In this work the authors have endeavored to give concise descriptions of all the species of fishes known to inhabit the waters of North and Middle America. A physical description of the fishes as well as habitat and taxonomy.

Keywords: Fish, Species list

JORDAN, D. S., B. W. EVERMANN, and B. W. CLARK. 1930. Checklist of the fishes and fish-like vertebrates of North and Middle America north of the northern boundary of Venezuela and Columbia. Rept. U.S. Comm. Fish. 670 pp.

Abstract: This list of fishes and fish-like vertebrates describes habitat, distribution, life histories and food habits.

Keywords: Fish, Species list, Habitat

JORDAN, D. S. and C. H. GILBERT. 1882. A synopsis of the fishes of North America. Bull. U.S. Nat. Mus. No. 16. 1018 pp.

Abstract: In this paper the authors have endeavored to give concise descriptions of all the species of fishes known to inhabit the waters of North America, north of the boundary between the United States and Mexico.

Keywords: Fish, Species list

JORDAN, D. S. and S. E. MEEK. 1885. List of fishes collected in Iowa and Missouri in August, 1884, with descriptions of three new species. *Proc.* U.S. Nat. Mus. 8(1):1-17.

Abstract: During the months of July, August, and September, 1884, a series of explorations of the streams of the south and southwest was undertaken. The present paper is the first of a series intended to place on record the result of these explorations. It includes the streams examined by the present writers, namely, the Des Moines, the Chariton, the Hundred and Two, and Missouri, and several tributaries of the La Mine and the Osage. Nearly all the specimens mentioned were obtained with a fine-meshed seine of large size.

Keywords: Fish, Species list, Iowa, Missouri, Survey

JORDAN, P. R. 1965. Fluvial sediment of the Mississippi River at St. Louis, Missouri. USGS Water Supply Paper No. 1802.

Abstract: The purposes of this report are to evaluate and interpret the sediment data, to show the effect of upstream developments on sediment concentration and discharge, and to present some theoretical aspects of sediment transportation as applied to the river.

Keywords: Sediment

JORDAN, P. R. 1968. Summary and analysis of sediment records in relation to St. Louis harbor sedimentation problem. Open File Rept. U. S. Geol. Sur., Water Resour. Div., 28 p.

Abstract: The combined flows of the lower Missouri and upper Mississippi Rivers commonly transport more suspended sediment, and sand in particular, than does the flow of the Mississippi River at St. Louis, resulting in deposition of sediment between Hermann and St. Louis in many years. Impoundments in the Missouri River basin have reduced the suspended-sediment discharge by at least 25 percent at Kansas City, but have had little effect on the discharge of sand which constitutes most of the deposition.

According to the calculations presented, the depth would be inadequate for docking at the Municipal Dock and some of the other docks about 9 percent of the time. However, this estimate should be used with caution because of the limitations of the data from which the assumptions and calculations were made. If is probably safe, however, to conclude that, in the absence of major changes in water use, river regulation, and channel geometry, troublesome deposits of sand will continue to be found periodically near the barge terminals.

Keywords: Missouri, Sediment, Sedimentation

JORGENSEN, S. E. and R. W. SHARP (Eds). 1971. Proceedings of a Symposium on Rare and Endangered Mollusks (Naiads of the U. S.) U. S. Dept. of the Interior, Fish and Wildlife Service Bureau of Sport Fisheries and Wildlife Region 3, Fort Snelling, Twin Cities, Minnesota.

Abstract: List of rare and endangered mollusks of the U. S. and what initial steps should be taken to prevent additional species being added to those already extinct.

Keywords: Benthos, Endangered species, Rare species, Mussels, Mollusks

JUDE, D. J. 1968. Bottom fauna utilization and distribution of 10 species of fish in Pool 19, Mississippi River. Masters Thesis, Iowa State University of Science and Technology, Ames, Iowa. 238 p.

Abstract: This study was initiated to determine the composition of bottom fauna and fish populations in the Fort Madison section of Pool 19, Mississippi River. Studies were initiated to survey the present ecological conditions prior to dredging. Benthos data were correlated to stomach content analyses to show the importance of the various faunal groups to fish and thus the necessity for their protection if threatened with destruction.

Keywords: Benthos, Fish, Pool 19, Distribution

JUDE, D. J. 1973. Food and feeding habits of gizzard shad in Pool 19 Mississippi River. Trans. Am. Fish. Soc. 102(2): 378-383.

Abstract: Examination of 344 of 1,368 gizzard shad captured mainly with gill nets during 1966-67 showed that intensive feeding began in April or early May and ended by early September. There appeared to be little correlation between diurnal activity and food consumption. Fingernail clams (Sphaeriidae), sand and unidentified material were the most abundant items found in larger gizzard shad. Larger shad captured in open waters consumed a larger percentage of bottom organisms, particularly fingernail clams, than did smaller shad. Comparison of numbers of fingernail clams (less than 5 mm long) in bottom samples versus volume of sphaeriids consumed by shad in the same areas revealed greater consumption in open water habitat where clam populations were highest. A significant weight difference at a given length was found between shad captured during summer from shallow water versus those from open water habitat, presumedly correlated with feeding habits.

Keywords: Fish, Food habits, Pool 19, Gizzard shad

KALLEMEYN, L. W. and J. F. NOVOTNY. 1977. Fish and fish food organisms in various habitats of the Missouri River in South Dakota, Nebraska and Iowa. U.S.D.I. Fish and Wildlife Service. FWS/OBS-77/25. 100 pp.

Abstract: Forty-six fish species were collected in the free-flowing river with emerald shiner, river carpsucker, channel catfish, gizzard shad, red shiner, shorthead rednose, yellow perch, carp and goldeye most abundant. The fish community was less diverse in the channelized river with carp, channel catfish and river carpsucker accounting for 70% of the catch. In free-flowing sections, fish used all habitats, but were most abundant in backwaters and marshes. Backwaters were important for spawning and nursery functions. Some species exhibited single habitat preferences, but most utilized several habitats for various life stages. In channelized sections, the largest catches were made in habitats created by notching dikes and revetments.

Zooplankton abundance was related directly to reservoir discharges. Macroinvertebrates, detritus and organic matter increased progressively downstream. Drift and particulate organic matter were most abundant in heavy currents of the channel.

Keywords: Fish, Food habits, Missouri River

KAMINSKI, C. F., JR. 1973. The effect of Lock and Dam 3 on macroinvertebrate species diversity on Pool no. 3 in the Mississippi River. B. A. Thesis, St. Mary's College, Winona, MN. 35 p.

Abstract: In the spring and summer months of 1973, a project was undertaken to determine the effect of Lock and Dam #3 on the species diversity of macroinvertebrates using artificial substrate samplers. The researched area comprised seven miles of the Upper Mississippi River from Diamond Bluff, Wisconsin to Red Wing, Minnesota.

Thirty-one genera comprising two phyla were identified as a result of both qualitative and quantitive studies. Of those, seventeen were common to both studies while six were exclusively qualitative and eight were exclusively quantitative. Differences were found in species diversity from transect to transect and balsa to concrete substrate. These indices ranged in value from 0.15 to 2.66, indicating different stages of ecological succession within the research area.

Keywords: Lock and Dam 3, Benthos, Pool 3, Habitat alteration

KAUFMAN, L. H. 1977. Plankton dynamics of the Mississippi River USA. The big Black River and 2 oxbow lakes in a record flood year 1972-1973. ASB (Assoc. Southeast Biol) Bull 24(2).

Abstract: Semi-monthly phytoplankton, zooplankton and physico-chemical analyses were conducted at 16 stations in the vicinity of the proposed Grand Gulf Nuclear Generating Station (Mississippi). Each water body had a distinct plankton assemblage prior to the dramatic rise in the water level of the Mississippi in Fall 1972. Plankton standing crops in the oxbows decreased more than an order of magnitude as the lakes were flushed by the flooding river. From November through June, plankton assemblances of the four water bodies reflected plankton composition and abundance of the Mississippi. An exceptional, brief period occured in late winter when the Mississippi temporarily withdrew into its banks, and the oxbow plankton was again distinct from the river plankton. Following three months of renewed flushing distinctive assemblages again developed in late June in all four water bodies.

Keywords: Production, Flood, Phytoplankton

KAUFMAN, R. I., and J. D. PERRINE. 1957. Control of Underseepage by Relief Wells, Trotters, Mississippi. Appendix D. Analysis of 1955 Well Flow and Piezometric Data. Appendix E. 1957 Pumping Tests. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 46 p.

Abstract: In 1950 an experimental relief well system was installed along the landside toe of the levee at Trotters (Mi 54), Mississippi to study the control of underseepage by means of relief well and the performance of a well system over an extended period of time. Appendix D contains the analysis and summary of piezometric and well flow data obtained during the high water of March-April 1955. Appendix E presents the description and analysis of pumping tests made on selected wells during February and March 1957 to compare the yield of certain wells with that obtained in 1950 when the wells were installed.

Keywords: Dike, Closing structure, Barrier, Hydrology, Flow

KAWATSKI, J. A. and J. C. SCHMULBACH. 1970a. Epoxidation of aldrin by a freshwater ostracod. J. Econ. Entomol. 64: 326-317.

Abstract: In many freshwater food webs, ostracods are important components because they are prey for many aquatic insect larvae and both small and filter-feeding fishes. Ostracods are benthic and littoral scavenging omnivores, filter-feeding on bacteria, protozoans, algae, and detritus. Since insecticide residues tend to become concentrated in materials composing the substrate probably significant initiators of or contributors to the biological magnification of insecticide residues in food webs. The ability (of lack of ability) of ostracods to metabolize, alter, or detoxify accumulated insecticides prior to transferring the residues to organisms at higher trophic levels could have serious consequences for aquatic and other food webs.

Keywords: Invertebrates, Benthos

KAWATSKI, J. A. and J. C. SCHMULBACH. 1970b. Chlamyodotheca arcuata: autoradiographic localization of ^{14}C-dieldrin. Trans. Am. Microsc. Soc. 89: 424-427.

Abstract: The uptake and storage of two chlorinated hydrocarbon insecticides, aldrin and dieldrin, in freshwater ostracods (Chlamydotheca arcuata (Sars)) was studied using autoradiographic technique. Although aldrin and dieldrin uptake occurred over a wide body surface area, absorption was primarily through the body integument and the gut; lesser amounts of either insecticide were taken up through appendages. The shell absorbed or adsorbed only small quantities. The storage of these insecticides was largely in body lipids.

Keywords: Invertebrates, Insecticides, Toxicant

KAWATSKI, J. A. and J. C. SCHMULBACH. 1971a. Accumulation of insecticide in freshwater ostracods exposed continuously to sublethal concentrations of aldrin or dieldrin. Trans. Am. Fish. Soc. 100(1): 565-568.

Abstract: Ostracods are widely distributed, omnivorous, scavenging crustaceans occupying benthic and littoral niches in ponds, lakes, and slow-moving streams where they filter-feed on bacteria, protoza, algae, and detritus. Since they are essentially primary consumers of both dead and living organic matter, ostracods potentially have the capacity to concentrate insecticide residues

from the substrate and water and introduce or reintroduce the residues to organisms at higher trophic levels. Ostracods may comprise a substantial portion of the biomass in various ecosystems and many are consumed by insect larvae and both small and filter-feeding fish. Sublethal, long-term, laboratory exposures of ostracods to two chlorinated hydrocarbon insecticides (aldrin and dieldrin), reported here, have demonstrated that these animals can innoucuously accumulate and store quantities of insecticides in excess of amounts which would be toxic if accumulated within shorter periods of time.

Keywords: Insecticides, Invertebrates, Benthos, Toxicant

KAWATSKI, J. A. and J. C. SCHMULBACH. 1971b. Toxicities of aldrin and dieldrin to the freshwater ostracod Chlamydotheca arcuata. J. Econ. Entomol. 64: 1082-1085.

Abstract: Acute toxicities of various mixtures of aldrin and dieldrin against laboratory-reared, insecticide-free ostracods, Chlamydotheca arcuata (Sars), were determined. The 24-hr immobility EC_55 values were 1.15 and 2.45 parts per billion for aldrin and dieldrin, respectively. Bioassay results from using combinations of aldrin and dieldrin demonstrated no synergism or potentiation with respect to the 2 insecticides. Ostracods which were laboratory reared in the presence of insecticide were also tested to determine if increased resistance or sensitivity to the chemicals had occurred by virtue of chronic exposure. Sublethal exposure to either insecticide through several generations produced populations which were more susceptible to both insecticides. In all instances, aldrin was about twice as toxic as dieldrin.

Keywords: Toxicant, Invertebrates, Benthos

KEENLYNE, K. D. Undated. Lists of Species Associated with Locks and Dams along the Mississippi. Unpublished. Mo. Dept. Cons.

Abstract: A list of species found associated with particular locks and dams of the Upper Mississippi River.

Keywords: Species list, Lock, Dam

KELLEY, D. W. 1946. Test net operations, northern section, 1946. UMRCC Invest. Rept. No. 32.

Abstract: Field work from Spechts Ferry, Iowa, north to Diamond Bluff, Wisconsin was conducted to assess the fish species composition.

Keywords: Species list, Research, Equipment

KELLEY, D. W. 1947. Species composition of the catch of the test-net operations, northern unit, 1946. UMRCC Invest. Rept. No. 15, 2 pp.

Abstract: A total of 1,638 sets, hauls, or drifts were made with nine types of gear, capturing 17,679 fish. Of these, 10,940 were game and pan fish, 5,146 were commercial fish, 1,270 were of the predator group, and 323 were forage fish.

Keywords: Species list, Research, Equipment

KELLEY, D. W. 1948. Report on Fairport catfish experiment. UMRCC Invest. Rept. No. 28, 3 p.

Abstract: Data is given for catfish caught near the Fairport station. Recorded were length, weight, sex, and gonadal condition.

Keywords: Iowa, Fish, Research, Catfish

KELLEY, D. W. 1949a. Field notes on commercial catch - buffalo nets. UMRCC Invest. Rept. No. 29, 4 p.

Abstract: During 1944-1945, observations of commercial catches were made in the Iowa - Wisconsin - Minnesota section of the Mississippi River by Greenback and Monson. This is a report of their observations of commercial buffalo net catches in Iowa - Wisconsin waters.

Keywords: Commercial fishing, Fish, Equipment

KELLEY, D. W. 1949b. Preliminary report on the buffalo net. UMRCC Invest. Rept. No. 31, 11 p.

Abstract: The buffalo net is legal commercial gear in the Mississippi River below Minnesota's southern boundary. It has been proposed that some study should be made to determine the advisability of legalizing it in Minnesota-Wisconsin boundary waters. It is the purpose of this report to bring together all the available in-

formation on that type of gear so that the most effective plan of study can be put into operation.

Keywords: Research, Commercial fishing, Equipment

KELLEY, D. W. 1949c. Suggested effects of the proposed twelve-foot channel on fish life in the Upper Mississippi River. UMRCC Invest. Rept. No. 35, 7 p.

Abstract: Plans for the establishment of a twelve-foot channel in the Mississippi River have been pending for several years. On May 19, 1949, at a meeting of the Upper Mississippi River Conservation Committee, representatives of the U.S. Army's Corps of Engineers presented a summary of such plans. They stated that they had been requested by Congress to determine the feasibility of such an increase in channel depth. We understand that when their study is completed it will be presented to the Congress who will then pass judgement on this project.

Keywords: Upper Mississippi River, Fish, Channelization, Habitat alteration, Twelve-foot channel

KELLEY, D. W. 1953. Fluctuation in trap-net catches in the Upper Mississippi River. U. S. Fish and Wildl. Serv., Spec. Sci. Rept., Fish. 101, 38 p.

Abstract: This paper attempts to evaluate some of the factors found to influence the catch of trap nets in the Mississippi River during the summer of 1948. This work was done in the upper third of Pool 8, which contains a large number of backwater lakes and interconnecting channels.

Keywords: Pool 8, Upper Mississippi River, Fishing, Backwater

KELLEY, E. W. and J. GREENBANK. 1947. Census of Miller Lake, a Mississippi River backwater. UMRCC Invest. Rept. No. 11, 12 p.

Abstract: In order that information concerning the total fish population of a typical backwater area in the northern section of the Mississippi River be available to the Upper Mississippi River Conservation Committee, a netting, fin clipping, and poisoning project was initiated in Miller Lake below La Crosse, Wisconsin during August, 1947. Information gathered from such

a project was deemed valuable for comparisons with the total fish populations of other areas and to check the relative efficiency of nets used in test netting operations in this section of the river. The area selected for study was judged typical after reconnaissance by plane and boat, a careful consideration of river maps, aerial photographs, and a personal knowledge of the river.

Keywords: Backwater

KEOWN, M. P., E. A. DARDEAU, and J. G. KENNEDY. 1977. Inventory of Sediment Sample Collection Stations in the Mississippi River Basin. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 498 p.

Abstract: An inventory of the sediment sample collection stations in the Mississippi River Basin pertinent to the mission of the Corps of Engineers was conducted; 433 stations were located. Data for the 433 stations are presented in tables. For stations on the Arkansas, Atchafalaya, Kansas, Mississippi, Missouri, Ohio, Old and Red river, these data include the river mile, water resource region, Corps of Engineers (CE) District, Office of Water Data Coordination (OWDC) station number, agency station number, station name, geographic coordinates of the station location, type of water body on which the station is located, period of record of the station, frequency and types of data collected at the station, method used to collect sediment samples, and agency reporting to the OWDC regarding sediment collection activities at the station. For other streams in the basin on which stations are located, the data in the tables include the CE District, OWDC stations are located, the data in the tables include the CE district OWDC station number, station name, period of record, and agency reporting to the OWDC. In addition, narrative summaries were prepared for 74 key stations selected on the basis of location, period of record, and reliability and reported data. The summaries are presented in Appendix A, and include information on the stations site location, the collection and laboratory analysis of sediment samples taken at the station, and the reduction and reporting of the resulting data.

Keywords: River bottom, Sediment, Missouri River, Ohio River

KIKLUS, S. P. 1969. The effect of Hyalella azleca on the density of fecal coliform bacteria in Pool 6 Mississippi

River. B.A. Thesis, St. Mary's College, Winona, MN. 39 p.

Abstract: Two artificial freshwater trough environments were constructed with the aim of paralleling the natural environment as closely as possible. One liter of river water of known fecal coliform content was placed in each of these troughs and 100 scuds, Hyalella azteca (Saussure), taken directly into one trough. This trough constituted the experimental situation while the trough lacking the scuds was considered the control situation. Water samples were taken from each trough at regular intervals and analyzed for fecal coliform bacteria by the membrane filter technique. Five runs were made varying in length from 24 to 96 hours. On Runs #4 and #5 a third trough environment was introduced into which were placed 100 scuds, Hyalella azteca, which had been "cleared" by a process of transfer through several days changes of sterilized river water.

Results showed that the presence of the scuds did not have a significant effect on the density of fecal coliform bacteria. The data was examined using an analysis of variance at the 95% level.

Keywords: Invertebrates, Benthos, Bacteria, Pool 6

KINGSBURY, P. J. 1970. Calanoid Copepods from the Forest to Prairie Transition in the Itasca Park Region of Minnesota. Iowa Acad. Sci. 77: 223-227.

Abstract: Calanoid copepods found in the summer survey of northwestern Minnesota lakes and ponds were: Epichura lacustris, Diaptomis oregonensis, D. leptopus, D. saskatchewanensis, D. nudus, and D. siciloides. Some diaptomid species correlated with vegetational type, E. lacustris, D. oregonensis, D. saskatchewanensis were characteristic of pine hardwood and mesic deciduous forest regions while D. nudus and D. siciloides were characterized of Oak-Savanna and prairie regions. D. leptopus was characteristic in shallow water habitats and occurred on both sides of the transitional area.

Keywords: Invertebrates, River pond, Zooplankton, Minnesota, Distribution

KITTRELL, F. W. 1958. Pollution of Interstate Water of the Mississippi River in the St. Louis Metropolitan Area. Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Prepared in cooperation with Missouri State Div. of Health, Illinois State Sanitary Water Board, and the Bi-State Development Agency of the Missouri-Illinois Metropolitan Area. 32 p.

Abstract: Following the request to the Surgeon General of the Public Health Service for a conference on Water Pollution in the St. Louis Area, it was decided that information contained in the Bi-State Development Agency Report, "Mississippi River Water Pollution Investigation, St. Louis Metropolitan Area" should be supplemented by bringing it up to data and expanding the analysis of dat. This report was prepared from data in the Bi-State report and from available information in files of interested agencies concerned with the interstate waters of the area.

Keywords: Pollution, Water quality

KLEIN, W. M., R. H. KALEY, and J. WEDUM. 1975. Environmental Inventory and Assessment of Navigation Pools 24, 25 and 26, Upper Mississippi and Lower Illinois Rivers: A Vegetational Study. Missouri Botanical Garden, St. Louis, Army Engineer Waterways Experiment Station, Vicksburg, Miss. 151 p.

Abstract: The purpose of the study was to provide a vegetation map and descriptions of vegetational types and their sucessional patterns to be used in an environmental impact analysis of the effects of maintenance and operation of the nine-foot navigation channel in Pools 24, 25 and 26 on the Upper Mississippi and Lower Illinois Rivers. Seven vegetation types were described after field examination of 116 stands: Two nonforest types, old fields and wetlands; and five forest types, willow, silver maple-cotton wood, silver maple-cottonwood-pin oak, pin oak, and oak-history. All of these types were mapped with the exception of old fields, which were omitted because they are often subject to cultivation after a short period of abandonment. The silver maple-cottonwood community was found to be the most extensive type. Analysis of successional trends indicated that ash (Fraxinus spp.) and American elm (Ulmus americana) may become more important in many of the silver maple forests and that pin oak forests may also replace them particularly in areas protected from flooding by levees.

Keywords: Upper Mississippi River, Lower Mississippi River, Illinois River, Pools 24-26, Vegetation, Survey, Ecology, Navigation

KLEINERT, S. J. 1975. Sources of polychlorinated biphenyls in Wisconsin. Wis. Dept. Nat. Res. 124 p.

Abstract: Work completed by the Wisconsin Dept. of Natural Resources and others to determine concentrations of PCB's in fish and to identify discharge sources in the state is summarized. The PCB problem in Wisconsin is a fishery problem caused by residues that have accumulated in certain fish in Green Bay, Lake Michigan, and the Upper Mississippi River in excess of FDA tolerance level of 5 ppm,. Data indicate that levels of PCB's in fish in the Upper Mississippi have declined in recent years. Fallout may be contributing much greater amounts of PCB's in fish than industrial and municipal effluents are contributing.

Keywords: Chlorinated hydrocarbons, Water quality, Discharge, Point source discharge, Fish, Pesticides, Effluent

KLEINERT, S. J., P. E. DEGURSE and T. L. WIRTH. 1968. Occurrence and significance of DDT and dieldrin residues in Wisconsin fish. Wis. Dept. Nat. Res., Tech. Bull. No. 41.

Abstract: Evidence of significant residues of the chlorinated hydrocarbon insecticides DDT and dieldrin in certain Wisconsin fishes prompted the Department of Natural Resources to conduct a survey to determine the amounts of these residues in a variety of fishes from many state waters. The present report presents all of the information obtained to date together with a discussion of the significance of these data. A perspective section is included to acquaint the reader with the use, movement and accumulation in the environment, concentration in fish, and general toxicity of DDT and dieldrin.

Keywords: Fish, Pesticides, Wisconsin, Toxicant

KLEINERT, S. J. and P. E. DEGURSE. 1972. Mercury levels in Wisconsin fish and wildlife. Wis. Dept. Nat. Res. Tech. Bull. No. 52.

Abstract: Mercury determinations were made on 1,824 fish fillet samples representing 139 locations covering 52 of Wisconsin's 72 counties and boundary waters of Lake Michigan, Green Bay, Lake Superior, and the Mississippi River. All Wisconsin fish analyzed contained some mercury. Mercury levels in fish from waters removed from any known source of mercury use averaged .19 ppm and ranged between .01 and .60 ppm mercury. The highest mercury levels, averaging about 1 ppm and ranging between .10 and 4.89 ppm, occurred in fish taken from sections of the Chippewa, Flambeau, and Wisconsin Rivers located below paper mills and below a mercury cell chlorine-caustic soda plant. Different species vary in mercury content, and the larger fish often contain higher concentrations of mercury than do smaller fish of the same species taken from the same water.

Keywords: Chemistry, Toxicant, Wisconsin, Fish, Wildlife

KLIMSTRA, W. D. 1969. Mammals of the Pine Hills-Wolf Lake-LaRue Swamp complex. Nat. Hist. Miscellanea, Chicago Acad. Sci. 188: 1-10.

Abstract: During 1950 to 1965 representatives of the Cooperative Wildlife Research Laboratory and members of the mammalogy classes have collected and recorded signs and observations in a 13.5 square-mile area in Union County, Illinois. Numerous publications reflect the uniqueness and diversity of this Pine Hills-Wolf Lake-LaRue Swamp Complex. Since this is previously documented, an attempt is made here to relate individual species to a specific habitat. During this above period 790 dates of trapping and/or observing were recorded including every month of the year. As a result of this 41 of the 59 species of mammals recorded for Illinois were observed, collected or recorded. Descriptions of classes included are: Marsupialia, Insectiuora, Chiroptera, Lagomorpha, Rodentia, Carnivora and Artiodactyla.

Keywords: Mammals, Illinois

KLINE, D. K. 1975. Mississippi River fishing habitats in Southern Iowa. Iowa Conserv. 34(1): 10-11.

Abstract: The Mississippi River along Iowa's southeastern border can provide a unique and varied fishing experience. The list of fishes caught by river anglers includes

more than 30 species and ranges from an occasional bowfin to the abundant bluegill. Creel surveys show that anglers in the lower one-half of the river have been most successful at catching bluegill, crappie, channel catfish, bullhead, white bass, drum (perch), sauger and largemouth bass. Anglers have taken over 100,000 fish from a single pool in one year. Indeed, the Mississippi River offers Iowa's anglers fishing opportunities that can be found nowhere else in Iowa. Most fishing is done in the main channel border, wing dams, side channels and sloughs rather than in the main channel which is used primarily by barges and towboats.

Keywords: Habitat, Sport fishing, Creel census

KLINE, D. K. 1977. Trends in the Commercial Harvest of Carp (Cyprinus carpio) and Freshwater Drum (Aplodinotus grunniens) from the Upper Mississippi River between 1953 and 1972. 39th Midwest Fish & Wildlife Conference, Madison, Wisconsin.

Abstract: The five states of the Upper Mississippi River Conservation Committee have made a standardized effort to collect commercial fishery data since 1953. The total yearly harvest of both carp and freshwater drum from 25 pool areas had increased during a 20-year period, but individual pools showed wide variations when partitioned into five year increments. A total harvest of 103,640,000 lbs of carp and 27,115,555 lbs of freshwater drum were reported during the period. The lowest harvest of carp was in 1953 (2,228,000 lbs) and the highest harvest was in 1971 (6,928,00 lbs). The lowest harvest of freshwater drum was in 1953 (691,000 lbs) and the highest harvest was in 1970 (1,940,000 lbs). Possible causes for the trends include pool size, habitat, year-class strength, reporting procedures, market demands and commerical fishing equipment changes.

Keywords: Upper Mississippi River, River pond, Fish, Harvest, Habitat, Commercial fishing, Carp, Freshwater drum

KLINE, D. K., J. GOLDEN, T. JUDY, D. PAULSON and J. HARDINGER. 1974. Mississippi River Investigations (Lower Reach), 1974, Pools 14, 15, 16, 17, 18 and 19, Mississippi River. Iowa Cons. Comm. Proj. No. 74-II-C-89. pp. 187-190.

Abstract: The general objective of this project was to familiarize the fisheries management personnel of the Lake Darling Station with the Mississippi River along the southeast border of Iowa and establish them as participants in resource management groups. Seven specific objectives were outlined to achieve this purpose. Each of these specific objectives was pursued during 1974. The purpose of this report is to give a brief summary of the data collected or work accomplished toward each objective.

Keywords: Pools 14-19, Iowa, Fish management, Research

KLINE, D. K., J. GOLDEN and M. WADE. 1975. Mississippi River Fishery Classificatin Survey. Huron Island (mile 421-426) and Wyoming Slough (mile 458-463). Iowa Cons. Comm. Proj. No. 75-III-C-116. pp. 135-145.

Abstract: The purpose of this project was to make a fishery survey of tow units. Fish and habitat diversity were the major areas of concern.

Keywords: Fish, Survey, Iowa, Habitat

KLOTTER, J. K. 1966. The freshwater clam Lampsilis ventricosa as a bilogical monitor of strontium-90 fallout. B.A. Thesis, St. Mary's College, Winona, MN. 39 p.

Abstract: A correlation can be seen between the results of this study and the program of nuclear weapons testing. The occurrence of strontium-90 has definitely been increased through the testing of nuclear weapons.

The strontium-90 content of Lampsilis ventricosa shells seems to support the theory that the concentrations of strontium-90 deposited in the spring rains is roughly proportional to the total amount of isotope injected into the stratosphere by the test series made during the previous year.

Lampsilis ventricosa appears to be a valid indicator of strontium-90 fallout when the results of this study are compared to similar analyses on fallout in rain and soil, milk, tap water, and wheat.

There appears to be a correlation between the calendar year in which growth layers are formed and their strontium-90 content. This correlation leads one to believe that the clam Lampsilis ventricosa is a good biological monitor of strontium-90.

The age and number of individual growth layers of the clam seem to have little effect on isotope concentration. The important factor is the calendar year in which the growth layer was formed, regardless of the clam's age.

Keywords: Clams, Nuclear fallout

KNAPIK, R. V. and BR. R. THOMAS. 1970. Determination of fecal and total coliform densities in a slough of Pool 6 in the Mississippi River. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: The densities of fecal and total coliform bacteria at nine locations in a slough of Pool 6 of the Mississippi River were determined for six days in the summer of 1970, using the membrane filter technique. The statistical analysis of the data obtained indicated that (1) the population densities do not increase significantly while the water is in the slough; (2) the bacteria do not tend to accumulate along either shore or in the midstream; (3) bacterial densities remain fairly uniformly distributed between surface and bottom water.

Keywords: Bacteria, Slough, Pool 6, Research

KNOWLES, R. 1963. A study of the distribution of woody plants in the three southeast Minnesota counties. Research paper presented to Graduate Council. Winona State College 60 p.

Abstract: Woody plant distribution was studied in Mower, Fillmore and Houston Counties of southeastern Minnesota during the summer of 1962. The study in this particular area was deemed important because of its diversified conditions with regard to vegetation, glaciation, and topography.

The prescribed area of study is dissected by a prairie and forest transition. The extreme eastern sector offers Minnesota's only contribution to the unglaciated region, known as the Driftless Section. Soil formation hinges heavily upon the parent material of glacial action and the distribution of loess. Topographically, the studied area also differs immensely from one extremity to the other.

Keywords: Minnesota, Vegetation, Survey, Distribution

KODADEK, C. R. 1969. Analysis of prefreeze faunal drift into a slough of the Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 25 p.

Abstract: Collections of invertebrate drift were made using trap nets. The collections were made every twenty-four hours and covered the period from November 24 to December 3, 1968. The area sampled was a slough in Pool 6 of the Mississippi River in the vicinity of Homer, Minnesota. The last sample was collected the day before the river froze. It was found that water insect nymphs and crustaceans were the largest component of the drift. Specifically, Ephemeroptera, Amphipoda, Eucopepoda, and Cladocera were present in larger numbers than other invertebrates. All the invertebrates, with the exception of the Cladocerans, seemed to decrease as the water temperature dropped. The Cladocerans showed fluctuations in their numbers which seem to best be explained by the amount of algal drift collected. A trend for the invertebrates to decrease in size as the temperature decreases is also observed. Rainfall did not seem to have any noticable effects on the number of invertebrates in the drift.

Keywords: Slough, Invertebrates, Pool 6, Survey

KOEHLER, L. W., JR. 1969. Diurnal periodicity in the drift of Hyalella azteca. B.A. Thesis, St. Mary's College, Winona, MN. 27 p.

Abstract: Invertebrate drift samples were collected for seven weeks during the summer of 1968. Sampling was done three days a week with four consecutive samples taken during each twenty-four hour period: day (9:00 A.M. to 5:00 P.M.); dusk (5:00 P.M. to 10:00 P.M.); night (10:00P.M. to 3:00 A.M.); and dawn (3:00 A.M. to 9:00 A.M.). The invertebrate of interest in this study was Hyalella azteca.

Keywords: Invertebrates, Activity, Distribution

KOENST, W. M. 1974. The effect of temperature on the early life history stages of the walleye (Stizostedion vitreum vitreum Mitchell). M.S. Thesis., Univ. MN. 91 p.

Abstract: Lethal, sublethal and optimum temperatures were determined for each stage of growth. The optimum temperature for fertilization was 6 C, ranging up to 12 C for high percentage hatch. Length to hatch eggs decreased

as temperture increased. Optimal temperature for survival of fry from hatch to juvenile stage was 21 C and juvenile optimal growth occurred at 22 C.

Keywords: Fish, Temprature, Research, Life history, Spawning, Walleye

KOLB, C. R. 1975. Geologic Control of Sand Boils Along Mississippi River Levees. Army Engineer Waterways Experiment Station, Vicksburg, MS. 34 p.

Abstract: A common problem during floods along the lower Mississippi River is the formation of sand boils on the landward sides of levees. If the hydrostatic pressure in the previous substratum landward of the levee becomes greater than the submerged weight of the topstratum, the uplife pressure may cause heaving and rupture at weak spots with a resulting concentration of seepage flow in the form of sand boils. This, in turn, can lead to piping and instability of the levees during critical high-water periods. The disposition of pervious versus impervious floodplain deposits beneath the levee and the angle at which such bodies are crossed by the overlying levees are controlling factors in the localization of sand boils. Thus recognition of alluvial landforms forming the riverbanks, the types of soils associated with them, and their detailed mapping in plan and profiles are important factors in levee design. Corrective design involves: (a) detailed delineation of the surface and subsurface geology; (b) careful selection of borrow pits to avoid stripping critically thin topstratum deposits, and (c) the use of riverside of landside berms of blankets and/or the installation of relief wells.

Keywords: Geology, Training structure, Sediment, Flood

KOLB, W., D. CORNETT, J. DIEHL, K. HASPERT, and R. OTERO. 1974. Inland Waterways Communications Study. Volume III. Appendixes ARINC Research Corp., Annapolis, MD. 325 p.

Abstract: Contents: Industry questionnaire; VHF communications coverage; Inland waterway simulation; Other waterways communications systems; System channel requirements; Vendor responses; Leased line systems cost analysis Microwave systems cost analysis; Satellite systems cost analysis; and Leased line office-to-office and office-to-vessel communications system.

Keywords: Ohio River, Illinois River, Missouri River, Models, Commercial boat traffic

KOPP, D. D. 1965. An analysis of the commercial fishing reports of the Upper Mississippi River for the years of 1955 to 1962. Thesis, Loras College, Dubuque, IA.

Abstract: In this paper the fishing results of Pool 11 will be related to the results of the entire Upper Mississippi River. Pool 11 is the backwater of Lock and Dam 11 at Dubuque, Iowa.

A number of common species that compose the majority of the commercial fishing catch will be considered in this paper.

Keywords: Commercial fishing, Upper Mississippi River

KOSEK, S. R. 1968. A study of nitrogen content of Mississippi River Pool 6 and streams tributary to it. B.A. Thesis, St. Mary's College, Winona, MN. 23 p.

Abstract: Nitrogen content of the waters entering and leaving Pool 6 of the Mississippi River were determined using standard procedures. Four streams tributary to the river were also sampled to determine nitrogen contribution of sources other than Winona. While analysis of the data indicated that Winona does not add significant amounts of nitrogen to the river, it is suggested that the position of the river sampling sites precluded determination of Winona's nitrogen contribution to the river. A twenty-four hour study was also done on the effluent of the Winona Sewage Treatment Plant. The plant is about 49% effective in removing all forms of nitrogen.

Keywords: Chemistry, Pool 6, Water quality

KRAMER, R. E. 1960. First year growth of the largemouth bass (Micropterus salmoides Lacepede) and some related ecological factors. M.S. Thesis, Univ. Minn. 61 p.

Abstract: Somewhat nuclear relationships about length, season and acclimation temperature. During first two weeks after fish rose from nest the amount of food consumed appeared to correlate with rate of growth. Size of food appeared to be related with increased growth. Variations in length of scales was positively correlated with relative condition factor.

Keywords: Fish, Age and growth, Research, Largemouth bass, Food, habits

KRASZESKI, M. 1976. Preparatory technique induced variations in selected heavy metal concentrations of the Mississippi River Channel catfish (Ictalurus punctatus). B.A. Thesis, St. Mary's College, Winona, MN. 37 pp.

Abstract: Heavy metal concentrations in fish may vary as a function of those techniques required to prepare fish for human consumption. Atomic absorption spectrophotometry is utilized to provide a quantitative analysis of metal concentrations. This technique requires that all tissue subject to analysis be placed in solution. A wet acid digestion is employed to achieve sample solutions. The excessive oils in the channel catfish (Ictalurus punctatus) render this organism unsuitable for the wet digestion techniques employed at SMC. Subsequent sample preparations should make use of a selective digestion procedure or a dry ash method.

Keywords: Chemistry, Fish, Research, Heavy metals, Channel catfish, Catfish

KUDO, R. R. 1934. Studies on some protozoan parasites of fish of Illinois. Ill. Biol. Monog. 13(1). 44 pp.

Abstract: Preliminary observations made by the author from August 12 to September 11, 1930 on some parasitic protozoa of fishes inhabiting the main water systems of Illinois.

Keywords: Protozoa, Parasites, Fish, Illinois

KUNSHEK, R. J., JR. 1971. Vegetational studies of two Mississippi River flood plains in west-central Illinois. M.S. Thesis, W. Ill. Univ. 129 pp.

Abstract: Two west-central Illinois Mississippi River flood plains were studies for speices composition, compared, and interpreted for successional patterns. One study area was located on the Alice L. Libbe Life Science Station, Warsaw, Illinois, and the other was an island located 3.2 kilometers upstream. All samples were taken in summer, 1968.

Keywords: Vegetation, Illinois

KUNZ, G. F. 1898. The fresh-water pearl and pearl fisheries of the United States. Bull. U. S. Fish. Comm., 17: 375-426.

Abstract: The origin, nature and value of pearls were discussed. Early history of unio pearls in North America was outlined. A lengthy discussion of the pearl industry in recent years followed with discussion of collection techniques. The use of unio for food and buttons (from the shells) was pointed out.

Keywords: Mussels, Production

KUTKUGH, J. H. 1958. Utilization of gizzard shad by game fishes. Proc. Iowa. Acad. Sci. 65:571-579.

Abstract: Examination of digestive tract contents of over 3,000 yearling and adult North Twin Lake game and pan fishes (comprising seven species) during 1953, 1954, and 1955 revealed forage fishes to be the predominant items.

Whereas young-of-the-year yellow bass were the principal forage species in 1953, gizzard shad, by virtue of a mass population irruption, constituted the dominant forage in 1954 and 1955. Utilization of insects by the predatory fishes were less when shad were readily available, then before.

Large walleyes constituted the only specimens examined in 1953 that contained gizzard shad. These shad were of a large size (unavailable to smaller fish) and represented the stock which gave rise to the tremendous recruitment observed in 1954 and 1955.

North Twin Lake gizzard shad, because of slower growth remain vulnerable to predation by a greater proportion of the predator populations over longer periods of time, than in some other waters.

Keywords: Fish, Food habits, Gizzard shad

LAFOSSE, SR. M. 1970. An estimate of the production rate of Asterionella formosa from mud and sand substrates at varying depths within a slough of the Upper Mississippi River, Pool No. 6. M.S. Thesis., St. Mary's College, Winona, MN.

Abstract: In the summer of 1969, two six-day continuous samples were taken from the benthos of a slough area outside of Homer, Minnesota. An adapted benthos emergent sampler was used to collect samples of the production of sand and mud benthos in varying depths: 3ft., 5ft, and 8ft. The samples were membrane-filtered, then slides were prepared and observed to determine the quantity of production of the benthic substrates. The organism, Asterionella formosa was used for this study.

Keywords: Primary production, Phytoplankton, Sediment, Slough, Pool 6

LAGARDE, V. E. and S. J. WINFREY, 1974a. Computer-Calculated Geometric Characteristics of Middle-Mississippi River Side Channels. Volume II. Side-Channel Contour Maps. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 78 p.

Abstract: Volume I of this report contains a description of the the procedures followed in quantifying several parameters that characterize the geometry of Middle Mississippi River side channels. This volume contains reduced reproductions of computer-calculated and -plotted contour maps, which were produced during the preparation of data for calculation of parameter values. All maps contain 5-ft-interval contours with elevation relative to mean sea level.

Keywords: Models, Side channel, Middle Mississippi River

LAGARDE, V. E. and S. J. WINFREY. 1974b. Computer-Calculated Geometric Characteristics of Middle Mississippi River Side Channels. Volume I. Procedures and Results. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 115 p.

Abstract: Several geometric characteristics of water-basin regimes, including basin size and shape, area underwater at specific water depth, and cross-sectional area, and commonly associated with benthic, plankton and fish community population structures, although little quantitative data are available to support the association.

This two-volume report describes a general procedure that was developed to calculate values of selected parameters used to define the above-mentioned geometric characteristics of any water-basin regime. The procedure was successfully applied to yield quantitative information for those parameters for 18 side channels of the Middle Mississippi River. Which of the parameters selected as quantitative descriptors of the characteristics are best indicators of animal community population structures is expected to be determined as a result of other projects currently under way at the U.S. Army Engineer Waterways Experiment Station. Volume I contains a description of the procedure and the results of implementing it; Volume II contains a set of computer-plotted contour maps for 18 side channels.

Keywords: Benthos, Plankton, Fish, Side channel, Ecology, Survey, Wildlife, Middle Mississippi River

LAGER, T. M. 1976. The effect of a thermal discharge on the macroinvertebrates in the Mississippi River near Monticello, Minnesota. Masters thesis. St. Cloud State University, St. Cloud, MN. 112 p.

Abstract: The study of thermal discharge on macroinvertebrate populations was conducted 6 September 1973 to 19 September 1974. Over 260,000 organisms were examined. It was thought that the quality of the benthic fauna was unchanged. The quantity, biomass and individual organism weight may have been influenced. The life cycles of Tricoptera, Ephemeroptera and Diptera were influenced on 24 occasions. Abundance peaks, biomass and organism weight patterns were the same for preoperational and operational phases.

Keywords: Invertebrates, Benthos, Minnesota, Thermal effluent

LAMB, R. Y. and R. B. WILLEY. 1975. The 1st parthenogenetic populations of Orthoptera saltatoria to be reported from North America. Ann. Entomol. Soc. Am. 68(4): 721-722.

Abstract: The first 2 cases of female-only populations of saltatorthopteroid insects in North America have been found in the camel-cricket genus Hadenoccus, species of which are ecologically important members of many cave communities east of the Mississippi River.

Keywords: Rare species

LAMM, F. T. 1975. Applying environmental impact statements to metropolitan area water resource projects. Presented at AWWA 95th Annual Conf., Minneapolis. Jun 8-13, 1975. p. 26.

Abstract: The relationship of the metropolitan council of the twin cities area, whose purpose is to provide a framework for orderly growth, to the NEPA 69 review process is discussed. Problems arising from NEPA in the proposed construction of a grain terminal along the Minnesota River within the flood plain and in a draft impact statement prepared for usage on maintenance dredging on the Upper Mississippi River and tributary waters are analyzed. The environmental impact statement process should be modified to require adequate environmental justification within the same document that justifies overall project need. Impact on all urban services, social impact, and economic feasibility.

Keywords: Minnesota River, Upper Mississippi River, Dredging, Minnesota

LANGEMEIER, R. N. 1965. Limnology of the Missouri River. Unpub. M. S. Thesis, Univ. of Missouri, 156 p.

Abstract: The present study is concerned with the limnology, drift benthos, and the ecology of the flathead catfish, Pylodictis olivaris (Rafinesque), from both sections of the Missouri River.

The information derived from these studies will provide basic information about this part of the Missouri River and will be useful in evaluating further changes in the physical, limnological and biotic characteristics of the river. Because these investigations were conducted in the unchanneled and channeled portions of the river, the result may also furnish basic information for evaluating future effects of channelization upon the biota of the river.

Keywords: Missouri River, Limnology

LARSON, C. L. 1964. Surface water of Minnesota. Minn. Farm Home Sci., 21:(3).

Abstract: The relatively large water area of Minnesota is not due to high rainfall or runoff, but to such factors as the generally flat topography, the action of receding glaciers, and a relatively cool climate.

Streamflow records have many uses. They indicate the amount of water available for use each year; sufficient length of record is necessary to determine the average annual amount available and to determine the variation from year to year. Distribution of flow within the year is also important. Streamflow records, including peak flows, are needed for predicting probable peak flows in the future. This is the first step in designing any channel, culvert, gully control structure, or any structure, handling runoff water.

Keywords: Minnesota, Hydrology

LARSON, D. L. 1974. Vegetation of dredge spoil in the Lost Island area of Pool 5. Rept. prep. for U.S. Army, Corps of Engr., St. Paul Dist.

Abstract: The purpose of this study was to determine the feasibility of vegetating dredge spoil as a method of sand stabilization.

One part of the study involved a survey of the natural vegetation of the dredge spoil. Samples of all plants growing in the areas covered by dredge spoil were collected and identified. Observations were made as to which plants grow best, where they grow best, and, when possible, why they grow where they do. A reference herbarium collection was prepared, and is being stored in the herbarium of Winona State College, Winona, Minnesota.

The second part of the study involved the establishment of vegetation plots of various grasses and legumes to determine their suitability for vegetating dredge spoil. Applications of fertilizer, mulch, mud, and water were used to determine how each would affect the success of the plants. Tree cuttings were also planted to determine factors influencing their success. Progress of all plants was checked regularly, and all observations recorded. This part of the study also involved conducting germination tests with those seeds used in the plots, the results of which are included in the appendix.

Keywords: Vegetation, Dredging, Pool 5, Habitat management

LARSON, S. P., W. B. MANN, IV, T. D. STEEL and R. H. SUSAG. 1976. Graphic and Analytical Methods for Assessment of Stream-Water Quality - Mississippi River in the Minneapolis-St. Paul Metropolitan Area, Minnesota. Geological Survey,

St. Paul, Minn. Water Resources Div. Metropolitan Waste Control Commission, St. Paul, Minn. 63 p.

Abstract: Historical records were analyzed to determine effects of population, pollution-control strategy, and other factors on water quality of the Mississippi River. Isopleths of DO (dissolved oxygen) concentrations and lines of equal stream temperature indicated periodic data could be used to guide sampling of certain critical conditions in time and space. Long-term records revealed generally mixed changes in quality in the Mississippi River. Several mean-time series were used to show seasonal variation in water quality and effects of initiation of wastewater treatment in 1938. Kendall's tau statistical test indicated a significant increase in DO in the upper reach of the river during the period of record. Significant trends in stream temperature were indicated for winter periods using Kendall's tau procedure. The Mann-Whitney statistical test gave estimates of a 98-percent confidence interval of the magnitudes of change.

Keywords: Population, Pollution, Water quality, Temperature, Minnesota

LARSON, T. and R. G. RANTHUM. 1977. The effects of commercial fishing through the ice on a winter congregation of channel catfish (Ictalurus punctatus) and flathead catfish (Phlodictis olivaris) in Pool 7 of the Mississippi River. Fish Manage. Rept. No. 99. Wis. Dept. Nat. Res., Bur. Fish. Manage., Madison, Wisconsin.

Abstract: A total of 5,747 catfish (more than 12 inches) were tagged in Pool 7 of the Mississippi River for the purpose of evaluating harvest of winter catfish congregations. Insufficient data obtained during the winter of 1973 and poor success with the disc tag resulted in an additional year of study and conversion to the floy tag. A known winter catfish schooling site in the north end of Pool 7 was chosen for study. Netting of the congregation revealed its composition was of equal proportions of fish from that area and from areas downstream. All fish tagged from the winter school were recaptured elsewhere. The time of formation of the congregation was during December or January. The school remained present at ice-out in late March. A Peterson estimate of the congregation in 1974 was 5,300. Less than three percent were harvested in two seine hauls.

In general, commercial, winter harvest of catfish in Pool 7 is low. The recent average winter harvest figure

of 543 pounds is less than one percent of the average, total annual commercial harvest of 67,652 pounds.

It was determined 590,000 pounds of commercial size catfish exist in Pool 7 of the Mississippi River. Catch curve analysis found the present total annual mortality rate to 48.2 percent. Of this, 12.2 percent is due to fishing and 36.0 percent to natural mortality. Increased harvest, even of winter concentration areas, would not harm the present catfish fishery, however, optium rate of harvest is not known.

Keywords: Commercial fishing, Fish, Pool 7, Ice, Catfish, Channel catfish

LATVAITIS, P. B. 1974. Preliminary fish tagging investigation in Pool 14 of the Mississippi River. Drum and Croaker, Volume 15 (74) No. 1.

Abstract: Tagging investigations are being carried out during the operational phase of the Quad-Cities Nuclear Power Plant on Pool 14 of the Mississippi River. Fishes are being tagged to determine how endemic certain species are to particular habitat locations. Movements are recorded to ascertain whether fishes will pass through the slight temperature differential created by operation of the diffuser pipe system.

Keywords: Fish, Pool 14, Nuclear power, Tagging

LAVAITIS, P. B., H. F. BERNARD and D. B. MCDONALD. 1976. Impingement studies at Quad-Cities Station, Mississippi River (January 1973 through December 1975). Mississippi River Workshop on Entrainment and Impingement, New York, New York (in press).

Abstract: The objectives of this paper are to summarize 3 years of impingement data that were collected during a variety of operational modes. Topics of discussion will include trash basket assessment method techniques, variability of impingement collections, attempts to mitigate impingement, comparison of impingement to estimated standing crop, and future impingement investigations at the Quad-Cities Station.

Keywords: Fish, Nuclear power, Standing crop, Impingement

LATVAITIS, P. B., B. I. MUENCH and R. M. GERHOLD. 1975. A history of fish impingement and results of attempts to mitigate

impingement with sound barrier and bubble screens at Quad-Cities generating station. Industrial BIO-TEST Laboratories, Inc., Northbrook, Illinois. 26 p.

Abstract: The objectives of this report are to briefly document the history of fish impingement at Quad-Cities Station and discuss the results of attempts to mitigate this impingement by an underwater sound system and an air bubble screen.

Keywords: Fish, Nuclear power, Impingement

LEE, L. J. 1972. Longitudinal profiles and related hydraulic properties of the Mississippi River system. Ph.D. Thesis, Washington University, St. Louis, MO. 276 p.

Abstract: Longitudinal profiles were plotted for the Mississippi River and its major tributaries from contours on the latest available topographic maps. Plotting of river, valley, and regional slope applying to a particular river was done in such a way that specific geographical points on one of these slopes could be correlated with the corresponding geographical point on the other. Regression equations were computed for eleven river properties, taken two at a time, for specific location along these rivers.

Keywords: Hydrology

LEFEVRE, G. and W. C. CURTIS. 1908. Experiments in the artificial propagation of fresh-water mussels. Bull. U.S. Bur. Fish. 38: 615-626.

Abstract: Thorough investigation of artificial propatagion, a detailed study of the life history and ecology of the Unionidae, emphasizing especially the geographical distribution of the group throughout the Mississippi Valley, the breeding habits and seasons, the physical conditions of the waters in which the differenc species thrive, food, enemies, and diseases, rate of growth, post embryonic development, and the mutual behavior of glochidia, or larvae, and fishes as parasites and host.

Keywords: Mussels, Research, Propagation, Life history, Distribution

LEFEVRE, G. and W. C. CURTIS. 1912. Studies of the reproduction

and artificial propagation of fresh-water mussels. Bull. U.S. Bur. Fish. 30: 103-201.

Abstract: Thorough investigation of the conditions under which ficial propagation might be possible, a detailed study of the life history and ecology of the Unionidae, with special reference to the geographical distribution of the group throughout the Mississippi Valley, the breeding seasons and habits, the physical conditions of the waters in which different species thrive and attain their maximum growth, food supply, enemies and diseases, rate of growth and the influence of environmental factors upon it.

Keywords: Mussels, Research, Propagation, Distribution, Life history

LENSMEYER, K. V. and H. D. TOMLINSON. 1972. Mississippi River temperature and thermal discharge. AICHE Water Sym. Series. Vol 69. 383 p.

Abstract: Mississippi River temperature data were compared to the temperature limits of the states of Iowa and Illinois. Historically, the established temperature limits were not exceeded under average temperature conditions but were exceeded on several occasions by the maximum observed temperature. The effect of the heated discharge upon the actual hourly river temperatures recorded over a 14-year period and by comparing these temperatures to the state standards. By comparative analysis it was determined that the standards were violated by both the actual and the simulated hourly river temperatures.

Keywords: Temperature, Thermal effluent, Ecology, Water quality

LEVERETT, F. 1921. Outline of Pleistocene history of Mississippi Valley. J. Geol. 29:615-626.

Abstract: A history of the Mississippi Valley relating present conditions to glacial times.

Keywords: History, Geology

LEWIS, H. 1967. The Valley of the Mississippi Illustrated. Minnesota Historical Society, St. Paul. 423 p.

Abstract: A book with colored lithographs of life and cities along the Mississippi River. The history of the river is told by stories of steamboating, explorations, and Indians.

Keywords: Minnesota, History

LEWIS, R. C. 1970. The Marginal Costs of Alternative Levels of Water Quality in the Upper Mississippi River. Water Resources Research Center. M.S. Thesis, U. of Minn. 59 p.

Abstract: An analysis of the problem of waste disposal from the Twin Cities and its effect on the recreational and aesthetic use of the Mississippi River downstream.

Keywords: Water quality, Upper Mississippi River, Minnesota, Recreation.

LEWIS, W. M. 1953. Analysis of gizzard shad population of Crab Orchard Lake, Illinois. Trans. Ill. Acad. Sci. 46: 231-243.

Abstract: The present study deals with the age-composition and rate-of-growth of a sample of 88 gizzard shad taken from Crab Orchard by use of an electric shocker.

Keywords: Illinois, Fish, Population, Gizzard shad

LIMPERT, R. J. C. 1974. Feeding preferences and behavior of whistling swans on the Upper Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 31 p.

Abstract: In the fall of 1973 a study was conducted to investigate the relationship between the food availability and water depth and the food habits and feeding behavior of whistling swans (Olor columbianun) on the Weaver marsh of the Upper Mississippi River. Vegetation samples taken in the area in September showed that the study area contained only the duck potato plant (Sagittaria latifolia) at a density of 2.8 plants per square foot and 6.5 tubers per square foot. The area received about 28,000 swan days of use during the study. When the area was resampled after the departure of the swans, no tubers were found in any of the samples. Observations on the amount of food eaten and wasted by the swans indicated that the swans were feeding on the duck potato tuber at a rate of approximately 6.1 pounds per day per swan. The swans used two feeding positions depending on the water depth. In shallow water (less than 1.5 feet) adult swans fed primarily by submerging only their head and neck. In deeper water (more than

1.5 feet) the adult swans fed mainly by up-ending. The swans seemed to prefer to feed in water less than two feet in depth.

Keywords: Food habits, Waterfowl, Upper Mississippi River, Behavior, Whistling swan, Birds

LIND, D. T. 1975. Variability in the resistance of the fathead minnow (Pimephales promelas Rafinesque) to hydrogen sulfide. M.S. Thesis, Univ. of Minn. 59 p.

Abstract: A series of acute toxicity bioassays was conducted to measure variability in response to hydrogen sulfide of fathead minnows collected in the fall of 1972, the winter of 1972-73, and the spring of 1973 from four chemically dissimilar Upper Midwestern lakes.

Two samples of fathead minnows from a laboratory strain were also tested, and the sensitivity to hydrogen sulfide of the laboratory samples was compared to that of the field samples.

All healthy samples of fathead minnows collected in fall, winter, and spring from the four lakes had similar resistance to hydrogen sulfide, but the two samples of cultured fathead minnows were significantly less resistant to hydrogen sulfide than the field samples.

Keywords: Fish, Toxicant, Research, Minnesota, Chemistry, Flathead minnow

LINK, L. E. JR. and A. N. WILLIAMSON JR. 1976. Use of Automated remote sensing techniques to define the movement of tow-generated suspended material plumes on the Illinois and Upper Mississippi Rivers. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 71 p.

Abstract: Sequential color-infrared aerial photos and corresponding surface water samples were obtained at selected sites on the Illinois and Upper Mississippi Rivers to examine the movement of tow-generated suspended material plumes. The aerial photos were digitized with a scanning microdensitometer, and optical density values were extracted for correlation with suspended material concentration data obtained by laboratory analysis of the water samples. Correlation of the optical density and concentration values for each site and for sample positions at each site did not produce a statistically significant relation between the variables. The poor correlation between optical density and concen-

tration values prevented quantitative definition from the imagery of the distribution of suspended material concentrations at the sites as a function of time. Digital data handling procedures were used to enhance the visibility on the imagery of the tow-generated plumes. The procedures applied were successful in delineating the movement and dissipation of the tow-generated plumes under favorable sun and water conditions.

Keywords: Illinois River, Upper Mississippi River, Pollution, Water quality, Temperature, Tow, Siltation, Turbidity, Remote sensing

LOPINOT, A. C. 1962, Illinois fishing guide. Ill. Dept. Conservation. Fisheries Bulletin.

Abstract: The purpose of this guide is to help the angler realize more fully the opportunities available for sport fishing in Illinois. All of the Department of Conservation fishing areas are included, together with a complete directory of streams and lakes in every county where sport fishing may be enjoyed.

In order to acquaint everyone with the most important fish to be found in Illinois waters, twenty illustrations are presented with detailed descriptions to aid in identification of the species to be encountered.

Keywords: Illinois, Fishing

LOPINOT, A. C. 1967. The Illinois mussel. Reprinted from the Proceedings of the 21st Annual Conference of the Southeastern Association of Game and Fish Commissioners, 1967 p. 567-576.

Abstract: At the turn of the century when mussel shells were raw material for pearl buttons, fishing for freshwater mussels in Illinois was a big business. After World War II the pearl button was replaced by plastic, and mussel fishing declined.

Once again, however, fleets of boats dredge the river bottoms for mussel shells because Japan is using the shells for producing cultured pearls. This is the story of mussel fishing and its relation to cultured pearls.

Keywords: Mussels, Illinois, Benthos, Harvest

LOPINOT, A. C. 1968a. Illinois fresh water mussel shell industry. Ill. Dept. Cons. Special Fisheries Report No. 24. Mimeo., 23 p.

Abstract: This article discusses the commercial harvest of mussel shells in Illinois. Data was gathered of weight and size of shells, number per species, use of shells, and price paid for shells.

Keywords: Mussels, Benthos, Illinois, Harvest

LOPINOT, A. C. 1968b. 1967 Mississippi River Pool 13 Sport Fishing Creel Census. Special Fisheries Report No. 23. Ill. Dept. Cons., Div. of Fisheries. 42 p.

Abstract: The 1967 creel census survey was conducted under the auspices of the Fish Technical Section of the Upper Missippi River Conservation Committee. Conservation agencies from the States of Illinois, Iowa, Minnesota, Wisconsin, and Missouri conducted a coordinated sport fishery creel census as part of a plan to creel the same pools once every five years. Pool 13 of the Mississippi River was creeled by Illinois in 1962 and again in 1967.

Keywords: Fish, Creel census, Pool 13, Illinois, Sport fishing

LOPINOT, A. C. 1970a. Illinois fishing guide. Ill. Dept. Cons. Fish. Bull. No. 1. 52 pp.

Abstract: The purpose of this guide is to help the anglers realize more fully the opportunities available for sport fishing in Illinois. All of the Department of Conservation fishing areas are included, together with a complete directory of streams and lakes in every county where sport fishing may be enjoyed.

Keywords: Fishing, Illinois

LOPINOT, A. C. 1970b. What fish is this? Ill. Dept. Cons., Fish. Bull. No. 2. 32 pp.

Abstract: The purpose of these identification charts is to help the angler to identify some of the fish that are caught in Illinois.

A fish fact chart is included, giving information on some of the fish as to their life span, type of food eaten, etc. The figures given in this chart will vary

according to climate, environment, and individual fish. Information on the accepted and local names of fish, the growth rate of fish and bait hook size chart are also included.

Keywords: Fish, Illinois

LUDESCHER, FR. K. F. and BR. T. F. MOSER. 1970. Survey of aquatic rooted plants in Lake Winona, M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: In response to the concern expressed by the people about the diminishing water quality of Lake Winona, a study was undertaken. Our contribution to this study was a survey of the rooted aquatic plants. Our investigation produced the following plants: Potamogeton crispus, Potamogeton pectinatus, Potamogeton interruptus, Zosterella dubis, and Nuphar variegatum. All were found at depths less than six feet and they covered 0.17% of the west arm and 0.62% of the east arm. Most vegetation grew on the north shore of the east arm in three feet of water on sand combined with some organic mud. Little vegetation was found on sand or on the organic mud. No vegetation was found on the clay which covers a portion of the bottom on the east arm. The organic mud found in the lake, especially in the west arm makes it undesirable for recreation. This mud can not be the product of present plant decomposition since the plants are so few. The rooted aquatic plants of Lake Winona seem to have a very limited effect on the water quality.

Keywords: Aquatic plants, Lake Winona, Minnesota, Water quality, Habitat alteration

LUGN, A. L. 1927. Sedimentation in the Mississippi River between Davenport, Iowa, and Cairo, Illinois. Ph.D. Thesis, University of Iowa. 104 p.

Abstract: Field work on which this paper is based was done during the summer of 1925 and consisted of direct study of the action of the river as an agent of sedimentation and systematic collection of samples of sediment from the bed of the river and from bars and islands and of samples of suspended debris. The end in view was to learn as much as possible about the transportation and deposition of sediment by this part of the river.

Keywords: Sedimentation, Iowa, Illinois

MADDEN, K. M. 1959. Fishing fine in '59 - Mississippi River. Iowa Conserv., 18(5): 130, 131, 135.

Abstract: The Mississippi River has proven excellent in all areas of fishing in the past and present. Walleye, sauger, catfish, bass and other panfish can be caught in abundance if you know where and when to fish.

Keywords: Fishing

MADRAMOOTOO-PELLET, S. 1977. Distribtuion of Pseudomonas aeruginosa in navigation Pool No. 8 of Upper Mississippi River. M.S. Thesis. Univ. Wis., La Crosse, Wis.

Abstract: Serological (pratical) and pyocin (efficient method) typing performed on 52 isolates. Serological type #1 was most prevalent (34.23) P. aeruginosa most commonly extracted from sediment samples, more frequent from surface slimes than feces of 52 fishes, and from plant parts below rather than above water surface. Predator fish rather than nonpredator types were more commonly found infected by bacteria. Important factors suggested were current velocities, availability of O_2 and nutrients, surface tension and possibly negative phototropism. All hypothesized was that the sediment served as a recycling agent for this opportunistic pathogen in the water.

Keywords: Distribution, Pool 8, Upper Mississippi River, Bacteria

MAIER, W. J., R. G. GAST, C. T. ANDERSON, and W. W. NELSON. 1976. Carbon contents of surface and underground water in southcentral Minnesota. J. Environ. Qual. 5(2):124.

Abstract: Available information on the importance of organic carbon as a water quality parameter is discussed. Data of a survey of the seasonal distribution of organic and inorganic carbon in ground, surface, and subsurface water in south-central Minnesota are described. Organic carbon concentrations are +4C2, 5-17, and 1-6 mg/l in ground, surface, and subsurface water respectfully, thus indicating that most organic materials are decomposed or retained in the upper layers of the soil with minimal transfer to groundwater. High organic carbon doncentration in surface water is due to biodegradation of vegetation and animal tissues in stream channels, marshes, impoundments, or at the soil surface.

Keywords: Minnesota, Hydrology, Water quality, Vegetation, Impoundment

MAIER, W. J., H. L. McCONNELL, and L. E. CONTROY. 1974. A survey of organic carbon constitutents in natural fresh waters. Minnesota Univ. Minneapolis. Dept. of Civil and Mineral Engineering. Office of Water Research and Technology, Washington, D.C. 12 p.

Abstract: The paper describes the initial phase of a study of organic and inorganic carbon measurements in some of the major bodies of water in Minnesota. Concentration levels are described and discussed in terms of flow variation and seasonal changes. Information about sources and composition of organic materials are reviewed and discussed.

Keywords: Flow, Pollution, Water quality, Chemistry

MALCOLM, R. L., and W. H. DURUM. 1976. Organic carbon and nitrogen concentrations and annual organic carbon load of six selected rivers of the United States. USGS Water Supply Paper 1817-F

Abstract: Special Report: Organic substances in waters and sediments of the Missouri, Mississippi, and Ohio Rivers, and of the Neuse, Sopchoppy, and Brazos Rivers in North Carolina, Florida, and Texas respectively are studied. Average dissolved organic carbon (DOC) concentrations in the Brazos, Mississippi, Missouri, and Ohio Rivers range from 3-4 mg/l, but DOC in the Neuse River is higher at 7.1 mg/l. DOC levels in the Mississippi, Neuse, and Ohio Rivers are relatively constant throughout the year, whereas DOC concentrations for the Sopchoppy River are highly variable and show no definite trends according to season. DOC concentrations show a definite trend to increase during the winter in the Brazos and Missouri Rivers. The finding that DOC levels are independent of stream discharge indicates that DOC concentration at any given time results from several dynamic processes within a given stream, such as sorption, desorption, scouring of bed material, and decomposition or organic litter. (1 map, 22 references, 5 tables).

Keywords: Missouri River, Ohio River, Sediment, Water quality, Chemistry.

MARAN, E. and D. J. SULICK. 1977. Advanced waste treatment design protects Lake Alton. Water Sewage Works 124 (4):68.

Abstract: Engineers at the Mississippi River Sewage Treatment Plant in St. Charles, MO., have combined conventional biological treatment with granular, activated carbon adsorption to produce a quality effluent suitable for recreational purposes. Design and performance of the plant, which protects the Alton Lake Recreational Impoundment, are described. Suspended solids are reduced by 99% and BOD by 97% prior to discharge to the Mississippi River.

Keywords: Effluent, Impoundment

MARTIN, J. A. Jr., C. ROBBINS, C. B. NELSON, R. D. COUSINS, JR., and M. A. CULLITON. 1976. A Computer Code (RVRDOS) to Calculate Population Doses from Radioactive Liquid Effluents and an Application to Nuclear Power Reactors on the Mississippi River Basin. Office of Radiation Programs, Washington, D.C. Environmental Analysis Div. 83 p.

Abstract: A computer program RVRDOS has been developed to calculate population doses due to releases of radionuclides into flowing streams. Concentrations of the radionuclides downstream take into account dilution, decay, and the ingrowth of a daughter product. Population doses to four organs are calculated for drinking water and fish ingestion pathways. Indivdual doses due to swimming may also be estimated. A program manual for RVRDOS is included in this report. RVRDOS has been used to calculate population doses due to releases from nuclear power reactors on the Mississippi River Basin during 1973. The data base for these calculations and a summary of the calculations are discussed.

Keywords: Effluent, Models, Population, Nuclear power, Water qualtiy, Pollution

MARTIN, L. 1932. The physical geography of Wisconsin. Chap. VII: The Mississippi in Wisconsin. Wis. Geol. Nat. Surv., Bull. 36, Educ. Ser. 4, 608 pp.

Abstract: A non-technical discussion of the physical geology of Wisconsin which describes the surface features of the state. Brief incidents in the history of the state and

relations of resources and industries to topographic and hydrographic features are also included.

Keywords: Wisconsin

MARTIN, R. G. and R. S. CAMPBELL. 1953. The small fishes of Black River and Clearwater Lake, Missouri. Univ of Missouri Studies 26:45-66.

Abstract: The small-fish populations in Black River, 1947, in Clearwater Lake, 1948 through 1950, are described in this section.

Sixty-eight species of fishes were collected in Black River and of these, 20 species were minnows. The minnows formed 77 percent of the total number of fishes collected. Other abundant species were smallmouth bass, rock bass, longear sunfish, black and golden redhorses, and hog sucker. The abundance and species composition of each family of small fishes collected in the river is discussed.

Three major habitats were studied in Black River - riffles, pools, and backwaters, the latter forming only a minor portion of the total water area. Habitat preferences is described for most species.

This section of the river was flooded in 1948. The species of small fishes found in the new Clearwater Lake in 1948 were similar to those in the river, but there were differences in relative abundance. The brook silversides, bluntnose minnow, bluegill, and longear sunfish together constituted 60 percent of the small-fish population. Their abundance was the result of a successful spawn in the new reservoir.

The reservoir population in 1949 was marked by an abundance of bluegill. They formed nearly 50 percent of the small fishes collected. The bigeye shiner increased in abundance also.

The fishes which had increased markedly by 1950 were species found originally in small numbers in the backwater of the river. They included gizzard shad, golden shiner, largemouth bass, and white crappie.

Keywords: Fish, Missouri, Survey

MATHSON, G. R. and K. J. WRIGHT. 1972. Mississippi River

Special Fall Tailwater Sport fishing creel census in Pools 7, 8 and 9, October 1, 1971 - November 30, 1971. Manage. Rept. No. 57, Wis. Dept. Nat. Res. Bur. Fish Manage. West Central Dist.

Abstract: A creel census was conducted in the tailwaters of Pools 7, 8, and 9 from October 1 to November 30, 1971, to assess the fall fishing pressure and success for walleye and sauger in the three pools. This survey was conducted under the auspices of the Fish Technical Section of the Upper Mississippi River Conservation Committee as part of a continuing evaluation of the sport fishery.

Keywords: Tailwater, Sport fishing, Pools 7-9, Creel census Survey, Harvest, Pressure

MATHSON, G. R. and D. F. GEBKEN. 1972. Mississippi River Special Tailwater Sport Fishing Creel Census in Pool 7, March 1 - April 30, 1971. Manage. Rept. No. 54, Wis. Dept. Nat. Res., West Central Dist.

Abstract: A creel census was conducted in the tailwaters of Pool 7 from March 1 to April 30, 1971 to evaluate the fishing pressure and harvest during a two month period previously closed to fishing for large game fish. The 1971 special tailwater creel census survey was conducted under the auspices of the Fish Technical Section of the Upper Mississippi River Conservation Committee as part of a plan to maintain a continuing evaluation of the sport fishery.

Keywords: Creel census, Pool 7, Tailwater, Survey, Fish, Sport fishing

MATTER, W. J. 1975. Invertebrate drift in the Mississippi River near Monticello, Minnesota. M.S. Thesis, St. Cloud State University, St. Cloud, MN. 80 p.

Abstract: Taxonomy composition, magnitude, seasonal fluctuation and vertical distribution of the drift were examined. The effect of heated discharge measured on drift parameters. Collection was from July 1973 to July 1974 from one site above and one site below station near Monticello, Minnesota.

Population was 28% Trichoptera, 37% Ephemeroptera, and 30% Diptera. Total drift through river cross section was $2.5 \times 10^6 - 76.9 \times 10^6$ in 24 hours. Abundance peaks

were in mid-August and early June. Some significant differences due to heat occurred. No measurable change in taxonomy composition or magnitude of drift.

Keywords: Intervertebrates, Minnesota, Benthos, Taxonomy, Disbution, Thermal effluent, Abundance

MATTISON, W. M. and J. F. LEINECKE. 1972. A radiotelemetric study of the behavioral ecology of white-tailed deer in the Upper Mississippi River. Flood Plain Environment. M.S. Thesis, St. Mary's College, Winona, MN.

ABSTRACT: This study of the behavioral ecology of white-tailed deer (Odocoileus virginianus) was conducted in the Mississippi River flood plain on the Trempealeau National Wildlife Refuge, Wisconsin, during the months of August, September, and October 1971. Radiotelemetry was used to determine movement patterns. The average home range of the three does that were collared was 118 acres which is considerably smaller than most other studies have indicated. The home ranges found in this study, and others, were used in an attempt to develop the relation between population density and home range size.

Keywords: White-tailed deer, Survey, Behavior, Ecology, Upper Mississippi River, Mammals, Distribution

MAUCK, W. L and L. E. OLSON. 1977. Polychlorinated biphenyls in aduly mayflies (Hexagenia bilineata) from the Upper Mississippi River. Fish pesticide research unit, Wis. B. Env. Contam. Tox. 17(4):387-423.

Abstract: Residue background of Aroclor 1254 in the adult mayflies collected from the Upper Mississippi River is determined. Mayflies from all of 14 stations contain significant residues. The adult mayfly may be a very useful indicator of chemical residue trends because it is abundant and can be easily collected around lights.

This study was initiated to determine the residue background of the PCB, Aroclor 1254, in the adult mayflies collected from the Upper Mississippi River. The mayfly was selected because of its great abundance in the river and its significance in the food web.

Keywords: Upper Mississippi River, Invertebrates, Chlorinated hydrocarbons, Mayflies

MAURER, J. W. 1962. Stomach analysis of the gizzard shad Dorostoma cepedianum in the Upper Mississippi River. B.S. Thesis, St. Mary's College, Winona, MN. 21 p.

Abstract: It can be seen from the plankton analysis figures that the shad ingests a vast majority of phytoplankton rather than zooplankton. However, it can also be seen that there is a much greater amount of phytoplankton available in the water than zooplankton. This study appears to indicate that shad consume more filamentous algae than zooplankton.

Keywords: Fish, Upper Mississippi River, Research, Phytoplankton, Zooplankton, Food habits, Gizzard shad

MAY, F. B. 1975. Food habits of the young-of-the-year smallmouth bass (Micropterus dolomieui, Lacepeds) in a thermal plume in the Mississippi River near Monticello, Minnesota. M.S. Thesis, St. Cloud State Univ., St. Cloud, MN. 81 p.

Abstract: Food habits of 666 young-of-the-year smallmouth bass from Mississippi River were examined. Early summer food was dipteran larvae and Ephemeropteran nymphs. Mayfly nymphs, Corixidae and Hydropsychidae important in summer. Fish are not important as food. Feeding habits change with substrate. Thermal plume didn't affect food habits.

Keywords: Food habits, Fish, Thermal effluent, Minnesota, Research, Smallmouth bass

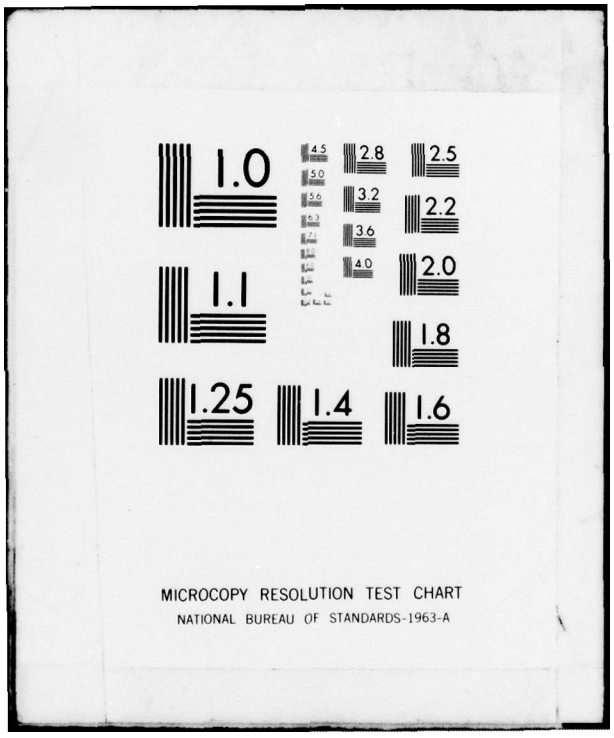
MAYHEW, J. 1973. SHAD - A computer program for the computation of age and growth statistics of fish. Ia. Fish. Res. Tech. Series No. 73-1. Ia. Cons. Comm., Des Moines, IA. 13 pp.

Abstract: SHAD is a complete age and growth program and contains routines for length-weight regression, body condition factors, body-scale regression, length-frequency distribution and back calculation of body length at the end of each year of life. The program provides routines for single and multiple regression analysis, analysis of variance, plotting and obtaining frequency distribution. The main routine controls the type and sequence of data input and serves as the supervisor for extrapolating all analyses, plots, frequency counts, transformations and means.

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Keywords: Age and growth, Gizzard shad

MCALLISTER, D. W. 1976. A spectrophotometric analysis of the total body burden of selected heavy metals in amphipod Gammarus fasciatus and trichopteran Hydropsyche. B.S. Thesis, St. Mary's College, Winona, MN. 26 p.

Abstract: Trichopteran Hydropsyche sp. and amphipod Gammarus fasciatus were obtained from Gilmore Creek for the purpose of determining the difference between heavy metal total body burden and biologically active heavy metal concentrations of chromium and copper. Total body burden was established on organisms frozen and stored for future analysis immediately after their collection. Biologically incorporated metal ions were determined by allowing living organisms to clear their gastrointestinal tract while sustaining them in creek water for one, three, five and seven days, respectively.

Keywords: Invertebrates, Benthos, Chemistry

MCCOMISH, T. S. 1971. Laboratory experiments on growth and food conversion by the Bluegill. Ph.D. Thesis, Univ. Missouri, Columbia, MO. 171 p.

Abstract: The effect of sex on growth of bluegills was investigated in long-term growth experiments. Differences in food consumption and growth between sexes tended to decrease as fish size increased.

The effects of hierarchy was also examined in a study on bluegills.

Keywords: Fish, Age and growth, Food habits, Research, Bluegill

MCCONVILLE, D. R. 1969. Macroinvertebrates of the Mississippi River in the Monticello Region. M.S. Thesis. St. Cloud State College, St. Cloud, MN. 85 p.

Abstract: Water samples were collected to establish the organic nutrient baseline of the river. Macroinvertebrates were collected June 1968 to June 1969. A qualitative sampling of shoreline macroinvertebrates showed Coleoptera, Ephemeroptera and Hemiptera to be present. Quantitative river bottom samples were collected. It was found that the fauna was dependent on current,

depth and river bottom characteristics and was composed of Trichoptera and Ephemeroptera.

Keywords: Invertebrates, Minnesota, Benthos, Water quality

MCCOY, O. R. 1928. Life history studies on trematodes from Missouri. J. Parasitol., 14(4):207-228.

Abstract: The life histories of trematodes from Ramona Lake near St. Louis are studied. New life histories were discovered for some species as well as 14 different species of larval trematodes.

Keywords: Life history, Research, Missouri, Invertebrates, Parasites

MCDONALD, D. B. 1972. Some chemical and biological characteristics of the Mississippi River bordering Iowa. AICHE Water Sym. Series Vol. 69. 380 p.

Abstract: Studies of the water chemistry of the Mississippi River bordering Iowa indicate that the water quality is good compared to streams within the state although there are limited stretches of river where deteriorated water quality conditions occur. Pollutants may also be introduced into the river as a result of runoff from agricultural land. Oxygen concentrations are usually adequate for fish life; however, low dissolved oxygen levels have been observed in slough areas accompanying the death and decay of large algal masses.

Keywords: Iowa, Water quality, Phytoplankton

MCDONALD, D. B. 1973. Some chemical and biological characteristics of the Mississippi River bordering Iowa. AICHE Symp. Ser. Water 69(129):380-390.

Abstract: The Mississippi River borders Iowa for approximately 300 miles. Within this area are a variety of habitats consisting of main channel, off-channel, lake, and slough areas. These habitats support a wide variety of fish of sport and commercial significance with over 50 species being reported from Pool 14 alone.

Studies of the water chemistry of the Mississippi River bordering Iowa indicate that the water quality is good compared to streams within the state although there are limited stretches of r ver where deteriorated water

quality conditions occur. Pollutants may also be introduced into the river as a result of runoff from agricultural land. Oxygen concentrations are usually adequate for fish life; however, low dissolved oxygen levels have been observed in slough areas accompanying the death and decay of large algal masses.

Keywords: Chemistry, Iowa, Water quality

MCDONALD, D. B. and J. L. KONEFES. 1977. Pre and post habitat conditions resulting from 9-ft. navigation channel, Upper Mississippi River, Pools 11-22. Univ. of Iowa, Inst. of Hydrol. Res.

Abstract: An inventory of habitat classification of Pools 11-22 prior to and after construction of a navigation channel and lock and dam system. Specific objectives were to determine changes of habitat types, to determine prior terrestrial habitat types that were submerged by the pool, and to describe new terrestrial habitats now bordering the pool.

Keywords: Channelization, Habitat alteration, Pools 11-22, Upper Mississippi River, Aquatic plants, Vegetation Nine-foot channel

MCDONALD, D. B. and M. P. MCDONALD. 1973. Environmental Assessment of the Proposed 12-foot Naviation Channel on the Upper Mississippi River. Report No. 73-1. Dept. of Civil Engneering, University of Iowa.

Abstract: The purpose of this study was to prepare a preliminary assessment of the potential environmental effects of the construction of a 12' navigation channel in the Mississippi River from St. Paul, Minnesota to the confluence of the Ohio River with the Mississippi near Cairo, Illinois.

The study considered environmental feasibility of providing a practical 12' navigation channel from the mouth of the Ohio River to Minneapolis, Minnesota, a distance of approximately 860 river miles. Initial authorizations for the 12' channel study were adopted in 1943. Although the initial authorizations were interpreted as limiting the scope of the study to the needs of commercial navigation, recent legislation relative to water resources planning has broadened the scope of the study, and the present 12' channel study includes environmental considerations.

Keywords: Channelization, Habitat alteration, Upper Mississippi River, Twelve-foot channel

MCLEOD, L. 1953. Wisconsin's fresh water sheepshead. Wis. Cons. Bull. 18(2): 27-29.

Abstract: Although found abundantly in the Mississippi River, sheepshead or freshwater drum are most common in Lake Winnebago. Because it is not as desirable as some of the game fish, control measures have been set up to regulate their numbers.

Keywords: Wisconsin, Fish, Sheepshead

MCMAHON, G. 1975. The impacts of dredge spoil placement on the Upper Mississippi River. Final Report. Nat. Sci. Foundation.

Abstract: Discussion of the possible adverse effects by the deposition of dredge spoil on natural environments. The positive effects are also recognized.

Keywords: Dredging, Upper Mississippi River, Habitat alteration

MCNABB, C. D., E. F. MILLER, and D. R. JOHANN. 1971. A fluorometric technique for sampling in large-river ecosystems. Minnesota Univ., Minneapolis. Water Resources Research Center. 22 p.

Abstract: A selection of the Mississippi River between miles 719 and 722 upstream from St. Louis was used to study large river ecosystems. The flow of the river during the time of the study was between 40,000 and 70,000 cfs. The dimensions of the area and the path of travel along which the movement of dye was studied are shown. Water along these paths does not intermix. One path is a continuation from upstream of the main navigation channel of the river. Tracer studies indicate that the water moving along this path through the study selection has little interaction with the immediate shore zone. The interest since the production upon which the food-web of the ecosystem is built appears to occur here. The limnological character of this water has been largely fixed by upstream mixing prior to entry on the path. Another path drains an inshore area that has a rather regular beach boundary upstream. Along this course, there is an input of water from shallow areas. These shallow backwaters are of parti-

cular limnological interest since the production upon which the food-web of the ecosystem is built appears to occur here. The areas of main current are likely avenues for the dispersal of this production.

Keywords: Upper Mississippi River, Minnesota, Ecology, Flow, Channelization, Backwater, Limnology, Hydrology, Biomass

MCQUIVEY, R. S., and T. N. KEEFER. 1976. Convective model of Longitudinal Dispersion. J. Hydraulics Div-Asce. 102 (10):1409.

Abstract: Longitudinal dispersion can be successfully modeled as a purely convective linear process for about one-sixth of the time required to reach the diffusive period. A system-response function developed from the low-law velocity profile may be used up to this limit. The remaining five-sixths of the convective period is modeled as a chain of linear convective systems. Data sets from four plume tests and three natural rivers are used to verify the use of the convective response function. Excellent results are obtained in all cases.

Keywords: Missouri River, Models, Discharge

MEEK, S. E. 1889. The native fishes of Iowa. Bull. Lab. Nat. Hist., St. Univ. Iowa., 1(2):161-171.

Abstract: A discussion of the native fishes of Iowa with reference to their habitat, distribution, life history, and identification.

Keywords: Fish, Iowa, Species list

MEEK, S. E. 1890. The native food fishes of Iowa. Proc. Iowa Acad. Sci., 1, pt. 1 (1887, 1888, 1889):68-76.

Abstract: Given in this paper is a systematic list of our native food fishes together with a few notes as to their distribution in our waters, their habits and their value as good fishes.

Keywords: Iowa, Fish, Species list

MEEK, S. E. 1892. Report upon the fishes of Iowa, based upon observations and collections made during 1889, 1890, and

Abstract: A study of the fish found in Iowa rivers. A list is given of the Rivers and the fish found there with common names and their frequency of occurrence.

Keywords: Fish, Iowa

MEGARD, R. O., W. S. COMBS, JR. and J. C. SETTLES. 1978. Planktonic algae, photosynthesis, and oxygen in the Mississippi River at Minneapolis and St. Paul, Minnesota. Contract MWCC # 469 for Metropolitan Waste Control Commission St. Paul, MN. 54 pp.

Abstract: Chlorophyll concentrations were measured during late summer, 1976 in the Mississippi River that flows by Minneapolis and St. Paul, Minnesota. Relationship between algae densities and rates of oxygen production and depletion were examined. Mechanisms that regulate the densities of algal populations were also investigated. A total of 58 river miles were examined, both above and below the metropolitan region and the waste treatment plant. Also fifty three other sites were looked at from the source at Lake Itasca to the Iowa border (approximately 650 river miles).

Keywords: Minnesota, Phytoplankton, Primary production

MEGLITSCH, P. A. 1942. On two new species of Myxosporidia from Illinois fishes. J. Parasitol., 28(1):83-89.

Abstract: A discussion of the parasites found on fish with a description of their habitat, trophic stage and spores.

Keywords: Parasites, Protozoa, Fish

MELVOLD, B. 1966. Commercial fishing. Iowa Conserv. 25(6).

Abstract: Commercial fishermen are limited to catching "rough" fish and face fines if they bring in game fish. Numbers of fish caught vary each day with a story of an ice seine haul of up to 50,000 pounds of fish.

Keywords: Commercial fishing, Fish

MENDELSOHN, R. A., W. J. SHEPPARD, and C. C. KIMM. 1973. Analysis of Inland Waterways Oil Transport Traffic Density Patterns. Battelle Columbus Labs, Ohio. 119 p.

Abstract: The report presents forecasts of oil traffic on 9 rivers and in 15 selected ports of the Mississippi River System. Included is crude oil, gasoline, distillate fuel oil, and residual fuel oil traffic moving on the inland waterways. A baseline forecast is developed using historical data and commodity volumes are projected for the years 1975, 1980, 1985, and 1990. These forecasts are revised on the basis of industry analysis, and converted to numbers of tow movements based on tow size projections.

Keywords: Missouri River, Illinois River, Commercial boat traffic, Models, Population

MERRICK, G. B. 1909. Old times on the Upper Mississippi. Arthur H. Clark Co., Clevland.

Abstract: The aim of the present volume is to tell something of these men, and of the boats that they made sentient by their knowledge and power; to relate something of the incidents of river life as seen by a boy during eight years of residence by the riverside, or in active service on the river itself.

Keywords: History

MERZ, E. A. 1975. A fourteen-year summary of commercial fishing for Carp, Buffalo, Freshwater Drum, Catfish and Bullhead on the Wisconsin Portion of the Mississippi River, 1960-1973. Fish Manage. Rept. No. 84. Wis. Dept. Nat. Res. Bur. Fish and Wildl. Manage.

Abstract: This report makes extractions from the commercial fishing statistics of 14 years, 1960-73 inclusive, for the Wisconsin portion of the Mississippi River. By means of figures, visual evidence of the nature of the fishery and trends in the fishery are made readily available for comparison and interpretation. Only the five most important species are included: carp, buffalo, freshwater drum, catfish and bullhead. These species comprised 98.0 percent of the 69,277,324 pounds taken during the period 1960 through 1973. The value of these species to Wisconsin commercial fishermen during that period was approximately $5,005,044.

Keywords: Wisconsin, Fish, Commercial fishing, Survey, Harvest, Statistics

MERZ, E. A. and J. A. HOLZER. 1977. Evaluation of Deep Water Trap Nets or Commercial Gear in Pool 4A (Lake Pepin). Mississippi River Fish Manage. Rept. 97. Bur. Fish Manage. Wis. Depart. Nat. Res., Madison, WI.

Abstract: Three deep water trap nets were fished in lake Pepin during the winters of 1975 and 1976. The nets accounted for 12,405 pounds of commercial fish for 1975 and 3,508 pounds in 1976. Freshwater drum dominated the commercial catch during both years. Fishing the trap nets was not a profitable operation. During 1975, the best year, $1,107.57 was made from the sale of commercial fish. This barely covered operating costs. The length of time between lifts and crowding of fish in the net had no effect on mortality during either year. Sport fish accounted for a significant portion of the total catch although mortality was low and limited primarily to white bass and black crappie. Gilling rate was 0.35 fish per met day in 1975 and 0.47 in 1976. Fat and moisture content analysis of drum samples showed that Lake Pepin drum contained significantly lower levels of fat and significantly higher percent of moisture than did the Pool 8 drum.

Keywords: Pool 4A, Fishing, Equipment, Lake Pepin

MERZ, E. A. and K. J. WRIGHT. 1974a. Three year summary of Mississippi River special fall creel census in pools 7, 8, and 9, 1971-1973. Manage. Rept. No. 74, Wis. Dept. Nat. Res., Bur. Fish. Wildl. Manage. West Central Dist.

Abstract: As part of a continuing evaluation of the sport fishery a creel census was conducted in the tailwaters of Pools 7, 8, and 9 from October 1 to November 30 in 1971, 1972, and 1973. The three-year fall census was conducted under the auspices of the Fish Technical Section of the Upper Mississippi River Conservation Committee. This report summarizes the three annual reports, Mathson and Wright (1972), Albright and Wright (1973), and Merz and Wright (1974) to evaluate the fishing pressure and harvest of walleye and sauger.

Keywords: Creel census, Pools 7-9, Sport fishing, Tailwater, Survey, Harvest, Statistics

MERZ, E. A., and K. J. WRIGHT. 1974b. Mississippi River special fall tailwaters sport fishing creel census, Pools 7, 8, and 9, October 1, 1973-November 30, 1973. Manage. Rept. No. 70, Wis. Dept. Nat. Res. Bur. Fish. and Wildl. Manage. West Central Dist.

Abstract: A creel census was conducted in the tailwaters of Pools 7, 8, and 9 from October 1 to November 10, 1973 to evaluate the fishing pressure and harvest. This census was conducted under the auspices of the Fish Technical Section of the Upper Mississippi River Conservation Committee as part of a continuing evaluation of the sport fishery.

Keywords: Tailwater, Sport fishing, Creel census, Survey, Pools 7-9, Harvest, Statistics

MERZ, E. A. and K. J. WRIGHT. 1975. Mississippi River special fall tailwaters sport fishing creel census, Pools 7, 8, and 9, October 1, 1972-November 30, 1972. Manage. Rept. No. 77. Wis. Dept. Nat. Res. Dist. Bur. Fish. Wildl. Manage. West Central Dist.

Abstract: A creel census was conducted in the tailwaters of Pools 7, 8, and 9 from October 1 to November 30, 1972 to evaluate the fishing pressure and harvest. This census wasconducted under the auspices of the Fish Technical Section of the Upper Mississippi River Conservation Committee as part of a continuing evaluation of the sport fishery.

Keywords: Creel census, Sport fishing, Survey, Tailwater, Pools 7-9

MILLER, R. C. 1976. Habitat correlation of wildlife to selected emergent vegetation in Weaver Bottoms, Minn. and Fountain City Bay, Wisc. on Upper Mississippi River. B. S. Thesis, St. Mary's College, Winona, MN. 64 p.

Abstract: The purpose of this study was to determine what relationships exist between wildlife and aquatic plants in the Weaver Bottoms of the Upper Mississippi River. Observations were made twice weekly at four selected sites from June through November. These sites were selected on the basis that the four plant types, arrowhead lotus, burreed/three-square, were locally abundant

and located near each other.

Keywords: Vegetation, Habitat, Wildlife, Minnesota, Wisconsin, Upper Mississippi River, Weaver Bottoms

MILLER, R. P. and H. A. KASSNER. 1973. Flood of '73. Water Spectrum 5(2): 30.

Abstract: The flood control plan procedures used during the flood of 1973 are discussed. The four major elements of the plan are levees, floodways, channel improvements, and major tributary improvement.

Keywords: Flood, Dam

MILLIGAN, J. D. 1961. The Federal Freshwater Navy and the Opening of the Mississippi River: its Organization, Construction, and Operations Through the Fall of Vicksburg. Ph. D. Thesis, Univ. of Michigan. 585 p.

Abstract: This study traces the history of the Federal Navy in the Mississippi valley from its inception, at a time when the great river was closed to Federal commerce, until vessels from the Northwest were again unloading their products at New Orleans. It is especially concerned with the role of the river service in helping to resecure the use of the waterway for the Union.

The opening chapter outlines the economic and military importance of the Mississippi River in the 1860's, both as it was interpreted by Americans, North and South, of that era and it is understood by present-day students of that period. In the first years of the war, citizens of the upper valley were convinced that Northern conquest of the river was the most important economic and military objective of the conflict. The second and third chapters describe how this conviction led to the construction of the fresh-water navy. The following nine chapters are mainly concerned with the operations of this navy, but also devote due space to its administration and expansion.

Keywords: History, Management

MILLS, H. B., W. C. STARRETT, and F. C. BELLROSE. 1966. Man's Effect on the Fish and Wildlife of the Illinois River. Ill. Nat. Hist. Surv., Biol. Notes #57, Urbana, Ill. 24 pp.

Abstract: This is a documented report on changes in the Illinois River, primarily in the past 75 years, with emphasis on the biological modifications which have occurred and are occurring as a result of man's activities.

Keywords: Illinois River, Habitat alteration, Fish, Wildlife

MINGO, R. T. 1970. Food preference of Hyalella azteca within Pool No. 6 of the Mississippi River. M. S. Thesis, St. Mary's College, Winona, MN.

Abstract: Six different aquatic plants were collected from a number of stations in Pool 6 on the Mississippi River to determine the food preference of Hyalella azteca (Saussure), a small crustacean amphipod. The six plant types collected and examined for the presence of H. azteca were as follows: Vallisneria americana, Ceratophyllum demersum, Elodea canadensis, Potamogeton pectinatus, Potamogeton crispus and Utricularia vulgaris. These counts indicated that C. demersum was the preferred habitat and probably food source of the H. azteca.

Keywords: Food habits, Invertebrates, Benthos, Pool 6

MISCHUK, M. W. 1976. Primary productivity in the Mississippi River near Monticello, Minnesota. M. S. Thesis, St. Cloud State University. St. Cloud, MN. 110 p.

Abstract: Measurements of primary production in a reach of the Mississippi River near Monticello, MN. were done from September 1973 to September 1974. The purpose was to determine the productivity of a reach in the Mississippi River from the Northern States Power Co. to Highway 25 bridge, 4.8km downstream, secondly, to determine the effect of heated condensor cooling water discharge on primary production downstream, and thirdly, to compare existing periphyton research to phytoplankton in the river. Primary production in the ambient zone ranged from 1.18 gm $0_2/m^2$/day to 49.83 gm $0_2/m^2$/day. Mean was 13.58gm $0_2/m^2$/day. In the heated zone it ranged from 0.49g to to 46.64gm $0_2/m^2$/day. Mean was 17.02gm/$0_2/m^2$/day. No statistical differences between the zones. Chlorophyll a concentrations ranged from 1.56 g/l to 15.78 g/l. Mean was 7.6 g/l in the ambient zone.

Keywords: Primary production, Minnesota, Thermal effluent, Discharge

MITRONOVAS, F. 1968. Laboratory Tests of Relief Well Filters. Report 1. Wells Along Mississippi River Levees, Alton to Gale, Illinois. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 49 p.

Abstract: Laboratory tests to obtain data on performance of gravel filters with gradations such as might result from segregation of a typical specified filter material were conducted using a typical slotted wood well screen, three filter gravel gradations (filters 1, 2 and 3), and a fine, uniform Mississippi River sand base material. Filter 1 had the average gradation of the normally specified filter gravel for relief wells in the Alton to Gale, Ill. project; filters 2 and 3 represented gradations that might result from segregation of filter 1. Peformance of the filters was evaluated by comparing their effectiveness in preventing piping of the foundation sand into the well, changes in head loss in the well screen and filter due to migration of materials, and effectiveness in preventing loss of sand and filter fines through well pipe perforations during surging.

Keywords: Dike, Illinois, Flow

MOHLENBROCK, R. H. and D. J. DRAPALIK. 1961. The Cyperaceae of Illinois. Amer. Midl. Nat. 67(2):398-423.

Abstract: This paper brings up-to-date the status of the cyperaceous genera Dulichium and Eleocharis in Illinois. A single species of Dulichium is recorded for Illinois; the genus Eleocharis is represented by 14 species. Keys, descriptions and general discussions are provided for each taxon.

Keywords: Illinois, Vegetation

MOLAMPHY, T. J. and R. E. CLEARY. 1959. Electro-fishing survey of Iowa waters of Mississippi River - May, 1959. Iowa Cons. Comm. Admin. Summary. Mimeo., unpublished. 24 pp.

Abstract: During the period May 4-16, 1959, a two-man electro-fishing crew surveyed 52 stations in the Iowa portion of the Mississippi River. Each station was subjected to one-half hour's shocking. Most of the stunned fish

that surfaced were boated. Game fish were measured and weighed individually; rough fish counted and weighed in in aggregate.

The largest buffalo were taken in the sloughs; the bluegills were equal sized in all habitats; the biggest walleyes preferred the channel; while the backwater lakes contained the largest carp, largemouth and sauger.

Keywords: Fish, Survey, Iowa, Electroshocking

MOLAMPHY, T. J. and R. E. CLEARY. 1960a. Electro-fishing surveys of Iowa waters of Mississippi River - 1960. Iowa Cons. Comm., Admin. Summary. Mimeo, unpublished. 2 pp.

Abstract: In 1960, routine shocker inventories were carried on partially in early May and also in September. High water after the first week of May forced postponement of traverses below Dubuque. As in past surveys, game species were weighed and measured separately, while other categories (Commercial, Predatory and Forage Fish) were counted and weighed in aggregate.

Keywords: Fish, Survey, Iowa, Electroshocking

MOLAMPHY, T. J. and R. E. CLEARY. 1960b. The 1960 trap-net survey of the Iowa waters of the Mississippi River. Iowa Cons. Comm., Admin. Summary. Mimeo., unpublished. 3 pp.

Abstract: In 1960 eight stations in the Iowa waters of the Mississippi River were inventoried with trap nets, to establish a comparative base with similar activities carried on in 1956 and 1957.

Limited length frequency data indicate that length is about similar but frequency lower in walleyes, sangers, largemouth bass and white bass. At most stations 6-7" bluegill dominated the net catches. The average size of both white and black crappie was larger in 1960 than previous years. Northern pike was more common in 1960, but size was unchanged. In 1960 sport fish accounted for a larger percentage of the weight of the catch than in 1956, both above and below Dubuque.

Keywords: Fish, Survey, Iowa

MONSON, M. A. 1946a. Size and maturity of hackleback sturgeon. UMRCC Invest. Rept. No. 9. 6 p.

Abstract: During the summer of 1946, 874 hacklebacks were weighed and measured in fish markets. Specimens were taken in Iowa and Illinois by commercial fishermen, using various types of gear. Specimens were examined in the fish markets at Lansing and Muscatine. The entire lot brought in at any one time was examined so any selectivity present in the sample is that of the gear and that caused by legal mimimun size limits.

Keywords: Age and growth, Fish, Hackleback sturgeon, Sturgeon, Life history

MONSON, M. A. 1946b. Analysis of total length - dressed length ratio studies on yellow bullhead, channel catfish, and flathead catfish. UMRCC Invest. Rept. 7. 9 pp.

Abstract: The field data on yellow bullheads were obtained at the

fish market at Lansing, Iowa. The work was done at Lansing as it was the one locality on the river where bullheads are taken in great number by commercial fishermen. At the time this information was collected, few brown and black bullheads were taken by the fishermen and yellow bullheads constituted virtually 100% of the bullhead catch. The data on channel catfish was done at Muscatine and Lansing, Iowa.

Keywords: Fish, Catfish, Length-weight

MONSON, M. A. and J. GREENBANK. 1947. Size and maturity of hackleback sturgeon. Upper Mississippi River Cons. Comm., Tech. Commit. Fish. Progr. Rept., 3: 42-5.

Abstract: Figures presented can give some idea of the size of the hackleback sturgeon at the attainment of sexual maturity. During the summer of 1946, hacklebacks were weighed and measured in fish markets.

Keywords: Age and growth, Fish, Hackleback sturgeon, Sturgeon

MONTGOMERY, R. L. 1972. Investigation of Relief Wells, Mississippi River Levees, Alton to Gale, Illinois. Army Waterways Experiment Station, Vicksburg, Miss. 119 p.

Abstract: Pumping tests, chemical and biological analyses of water samples, and well screen inspection by means of a borehole TV camera were conducted in 1969 as part of a study of the efficiency of the relief well system along the Mississippi River between Alton and Gale, Illinois. The purposes of this study were to determine the extent and causes of well deterioration and to investigate methods for improving and maintaining the efficiency of the well system. The relief wells were designed by personnel of the U. S. Army Engineer Waterways Experiment Station and built under the supervision of the U. S. Army Engineering District, St. Louis (SLD). The wells included in this investigation were installed between 1953 and 1955. Since then, SLD has performed a series of well pumping tests, periodically inspected the relief well system, and observed the operation of the wells during high river stages of the Mississippi River.

Keywords: Illinois, Hydrology, Flood, Bacteria

MONTZ, G. N. 1972. A seasonal study of the vegetation on levees. Castanea 37(2): 140-146.

Abstract: The frequency and percentage composition of plants was determined on levees in East St. Charles Parish (County), Louisiana. This parish is west of New Orleans and is bounded on the south by the Mississippi River and on the north by Lake Pontchartrain.

The vegetation was sampled by 55 line transects at the same locations in February-March, May-June and August-September.

Eighty-nine species were recorded in this study. Field notes indicate vernal, estival and autumnal flowering periods in the area. Eleven species were noted to flower only in the February-March study, six species only in the May-June study and eight species only in the August-September study.

Keywords: Vegetation, Dikes, Levees

MOONEY, C. E. 1964. Rail-Barge Competition in the Missisippi Valley: An Empirical Study of Inland Water Transportation. Ph. D. Thesis, Washington University, St. Louis, MO. 152 p.

Abstract: The main body of the study is concerned with two major objectives. First, it is an empirical analysis of barge transportation on the Mississippi River. The analysis seeks to assess the relevant market structure components such as cost and demand characteristics, pricing policy, market concentration, and intra-industry competition. The material in this section provides the basis for the comparison of rail-barge competitive relationships which comprises the second part of the study.

In the second section the impact of regulation upon the structure or barge transportation is analyzed, and the subsequent effect this has had upon the pricing behavior of the regulated water carriers. Regulation of rail-barge competition is examined separately from the direct economic regulation of the barge industry. This distinction was made in order to identify the consequences of each.

Keywords: Commercial boat traffic, Barges

MORGENWECK, R. O. 1971. A survey and distribution study of the Cyprinid minnows (Family Cyprinidae) in the Monticello Region of the Mississippi River. M. A. Thesis, St. Cloud St. Univ., St. Cloud, MN. 63 p.

Abstract: During 1970 fifteen species of fish totalling 7,248 specimens were collected. Twelve species were minnows and darters. Six sites were sampled, two above Monticello and four sites below. Food habits, age, total length and number of eggs were examined and found to be related.

Keywords: Survey, Distribution, Fish, Food habits, Age and growth, Minnesota, Cyprinids

MORGENWECK, R. O. and A. J. HOPWOOD. 1971. Cyprinid minnows of the Mississippi River at Monticello, Minnesota. St. Cloud St. College, St. Cloud, MN.

Abstract: Over 7000 fish representing 15 species were collected from six locations in the Mississippi River. Species were ranked in order of abundance.

Keywords: Survey, Distribution, Fish, Minnesota, Cyprinids

MORMANN, D. N. 1971. A survey of the species of fish and major forest, marsh, meadow and aquatic flora of a Mississippi River backwater. B. A. Thesis, St. Mary's College, Winona, MN. 37 p.

Abstract: This study was done to find out what sort of life forms inhabit the Prairie Island backwater, and to establish base data for future studies that may take place in the area after an industrial complex is built there. The topography of the area was compared to earlier records to find out what the recent changes in the area have been. A survey of the ground cover of major plants was made in the forest, marsh, meadowland and water areas.

Keywords: Survey, Fish, Vegetation, Aquatic plants, Backwater, Wetlands

MORRIS, R. L. and L. G. JOHNSON. 1969. Pesticide levels in Iowa birds and fish eggs. Iowa State Hygienic Lab. Rept. No. 70-12. Iowa City, IA. 8 p.

Abstract: This study involves the eggs of pheasants, water birds (coot, blue winged teal) and several varieties of fish. Dieldrin and heptachlor eporcide occur in significant but highly variable amounts in pheasant eggs. One pheasant egg contained a high concentration of lindane. DDT products in coot and blue winged teal are roughly 10 times greater than in pheasant eggs because DDT and its metabolites tend to concentrate in the aquatic environment. Dieldrin content in most fish eggs is relatively uniform and higher than in water bird eggs. Bullhead are quite low in all pesticide residues. Two samples of Mississippi River fish eggs contained numerous chemicals which appear to be polychlorinated biphenyl compounds.

Keywords: Pesticides, Iowa, Birds, Fish

MORRIS, R. L. and L. G. JOHNSON. 1970a. Pesticide levels in fish and bottom silt from Iowa streams. Iowa State Hygienic Lab. Rept. No. 71-10. Iowa City, IA.

Abstract: Some fish collected were from the Mississippi River near Dubuque, Muscatine and Burlington, Iowa. Catfish collected had the pesticide dieldrin ranging from 73 to 435 ppb.

Keywords: Pesticides, Iowa, Fish, Sediment

MORRIS, R. L. and L. G. Johnson. 1970b. Pesticide levels in fish from Iowa streams. Iowa State Hygienic Lab. Rept. No. 71-23. Iowa City, IA. 6 p.

Abstract: This research examined different types of fish and their pesticide levels.

Keywords: Fish, Pesticides, Iowa

MORRIS, R. L. and L. G. JOHNSON. 1972. Dieldrin levels in fish from Iowa streams. Pest. Monitoring Jour. 5(1):12-16.

Abstract: The use of aldrin as an agricultural pest control chemical on Iowa row cropland results in dieldrin levels in the edible portion of adult catfish exceedin FDA action guidelines by up to five times. The elevated dieldrin levels are widespread and appear also in carp and buffalo but not in pan and game fish species such as bass, crappie, bluegill, walleye, and northern pike, probably due in part to different feeding habits.
Fish taken from rivers not draining row cropland do not exhibit this phenomenon.

Pesticides apparently are adsorbed on soil particles and move into streams during ran or snow-melt runoff on erosion silt. Improved soil conservation practices resulting in reduced siltation must be instigated on a broad scale to keep agricultural pesticides on the fields and out of streams.

Keywords: Iowa, Pesticides

MORRISON, M. J. 1959. Ecology of the dams of Lake Pepin. B. A. Thesis, St. Mary's College, Winona, MN. 50 p.

Abstract: This study involves data collection from clams collected from Lake Pepin. Species collected and growth are compared to collections made earlier by other researchers.

Keywords: Lake Pepin, Clams, Ecology, Mussels

MORROW, J. J. 1974. Colloid Destabilization with Cationic Polyelectrolytes as Affected by Velocity Gradients. J. Am. Water Works Assoc. 66(11):646.

Abstract: Cationic polyelectrolytes can effectively destabilize colloidal and particulate matter without the use of inorganic salts by applying increased mixing energy to

rapid-mix basins. Comparing sludges produced by polyelectrolytes and inorganic coagulants indicates that polymer sludge has a greater density, more rapid settling, improved dewatering characteristics, and significantly lower volume.

Keywords: Sedimentation, Siltation

MOTTRAM, P. E. 1963. The strontium-90/calcium ratio in freshwater clam shells of the Upper Mississippi River. B. A. Thesis, St. Mary's College, Winona, MN. 19 p.

Abstract: This study showed (1) that there is a correlation between the calendar year of formation of the annual growth layers of Lampsilis ventricosa and Lampsilis siliquoidea and the concentration of strontium 90 in those layers; (2) that Lampsilis ventricosa concentrates more stronium 90 per gram of calcium carbonate in its shell than does Lampsilis siliquoidea; and (3) that the effect of age on concentration is doubtful, although Lampsilis ventricosa demonstrates a tendency to discriminate more against the isotope as it grows older.

Keywords: Chemistry, Clams, Benthos, Upper Mississippi River

MOYLE, J. B. 1945. Some chemical factors affecting the distribution of aquatic plants in Minnesota. Am. Midl. Nat. 34: 402-420.

Abstract: Since Minnesota waters exhibit a wide range of general chemical characteristics, it was decided in 1934 to examine the relationship existing between the chemical nature of the waters and the general distribution of aquatic plants.

Field surveys were made of 225 lakes and streams scattered over the entire state. Waters were selected that were representative of the chemical range of Minnesota surface waters. The plants inhabiting the different bodies of water were recorded.

Keywords: Chemistry, Distribution, Aquatic plants, Minnesota

MOYLE, J. B. 1975. The uncommon ones - animals and plants whch merit special consideration and management. Minn. Dept. Nat. Res. Spec. Publ. 32 pp.

Abstract: This publication does not constitute a list of endangered and threatened species. It is a discussion of the biological status of some of the Minnesota animals and plants in need of special management consideration.

Keywords: Minnesota, Vegetation, Mammals, Fish

MUELLER, A. J. 1977. Navigation effects in the open river. Proc. 33rd. Ann UMRCC Mtg. pp. 59-64.

Abstract: From the Upper Mississippi River to the "open river" or Middle Mississippi, the river has significantly narrowed. The Middle Mississippi River also has more rock and sand.

Almost all of the aquatic vegetation in the Middle Mississippi River has been eliminated by the extreme fluctuations of water levels and sedimentation.

One reflection of habitat destruction on the Middle Mississippi is the commercial fish catch. These are very rough figures and certainly nothing you could stand on very long, but the Middle Mississippi constitutes approximately 23% of the mileage of the Upper Mississippi River, yet on the average it has contributed only 2% of the commercial fish catch over the period of record.

Keywords: Navigation, Sediment

MUENCH, B. I. 1964. The Northern Pike in Illinois. Ill. Dept. Cons. Div. of Fish. Fish. Manage. Mimeo No. 29.

Abstract: The largest game-fish predator type in Illinois is the Northern Pike. This species can range up to twenty pounds in weight. Distribution and habitat preference is discussed. Stocking and management plans in Illinois are explained and the best fishing techniques are discussed.

Keywords: Northern Pike, Illinois

MUNSON, B. H. 1975. Behavioral reactions of juvenile rainbow trout (Salmo gairdneri) to a heated thermal plume. M. S. Thesis, Univ. of Minn. 33 p.

Abstract: Thermal plumes were injected midway in an eight foot trough of flowing water to test their influence on juvenile rainbow trout traversing the length of the trough to obtain food. Control behaviors were established at each of three acclimation temperatures: 6 C, 10 C and 15 C. Trials were then alternated between control conditions and trials where the feeding end of the channel was heated at 3 C intervals above acclimation. Behavioral changes in the approach to the food were noted at plume temperatures of 12 C or more above the acclimation temperatures. At temperatures of 21 C to 24 C above acclimation, fish entered the feeding area even though these temperatures exceeded their critical thermal maximum. Deaths among fish experiencing those thermal changes were common. No plume avoidance was established at any temperature, but an effective physiological barrier was found to occur at temperatures of 21 C to 24 C above acclimation.

Keywords: Thermal effluent, Fish, Behavior, Rainbow trout

MURAKA, I. P., A. J. POLICASTRO, J. G. FERRANTE, E. W. DANIELS, and G. J. MARMER. 1976. An Evaluation of Environmental Data Relating to Selected Nuclear Power Plant Sites. Argonne National Laboratories, Argonne, Illinois. ANL/EIS-2.

Abstract: Our analysis of the field data gathered during the monitoring programs at seven nuclear power plant sites show no significant ecological impacts. This conclusion is within the constraints of the quality of available data from these sites. Current monitoring programs are, however, not designed to meet the needs for statistical analysis and, consequently, the monitoring data are often ill-suited for modern statistical procedures. Recommendations are proposed for revising monitoring schemes so that more precise conclusions can be made from fewer field measurements.

Keywords: Thermal effluent, Nuclear power

MUSGROVE, J. W. and M. R. MUSGROVE. 1977. Waterfowl in Iowa. State of Iowa, Des Moines, IA. 130 p.

Abstract: An identification key to ducks, geese and swans of Iowa. For each species discussed, the description, field marks, call, migrations, breeding, winter range, food, and Iowa status is given.

Keywords: Waterfowl, Iowa, Ducks

NAKATO, T. and J. F. KENNEDY. 1977. Field Study of Sediment Transport Characteristics of the Mississippi River near Fox Island (RM 355-6) and Buzzard Island (RM 349-50). Iowa Inst. of Hydraulic Research, Iowa City, IA. 95 p.

Abstract: The field study was conducted in order to obtain a better understanding of the flow and sediment-transport mechanisms responsible for the recurrent shoaling that has been experienced in the vicinities of Fox Island (RM-355-6) and Buzzard Island (RM-349-50) in Pool 20 between Keokuk, Iowa, and Canton, Missouri, in the Mississippi River. Three sets of detailed data on transverse and streamwise distributions of flow velocity, suspended sediment discharge, bed-load discharge, bed-material properties, and flow depth were obtained for the high, intermediate, and low river stages during the period between May and September, 1976.

Keywords: Sedimentation, Pool 20, Iowa, Missouri, Flow, Turbidity, Side channel, Dike

NASH, N. 1958. Jugging the Mississippi. Mo. Conserv. June

Abstract: This article describes the art of jugging for fish on the Mississippi. Older fishermen say the term jugging came from whiskey jugs which were used to attache lines to. Methods of jugging and bait used are discussed.

Keywords: Sport fishing

NEEDHAM, J. G. 1920. Burrowing mayflies of our larger lakes and streams. Bul. U.S. Bur. Fish. 36:267-292.

Abstract: Discussion of mayfly species with reference to their habitat, morphology and taxonomy.

Keywords: Invertebrates, Distribution, Benthos, Mayflies

NEILSON, F. M., and A. R. TOOL. 1976. Prototype Tests, Old River Low-Sill Control Structure, April 1973 - June 1975. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 108 p.

Abstract: The following four separate series of prototype tests at Old River Low-Sill Control Structure are presented in this report. (1) High-flow vibration tests (4-5 April 1973), comprised of acceleration measurements, were made

to determine the magnitude of the vibration of the structure under higher than normal flows. (2) Vibration monitor tests (16 April-1 June 1973), comprised of acceleration measurement, were made during a period in which the structure was not in a structually sound condition. (3) Demolition tests (16-25 September 1973 and 4-15 November 1974), primarily acceleration measurements (with limited geophone and pressure cell data), were made during a period in which demolition activities (using explosive charges) were taking place near the structure. (4) Low-sill gate load tests (May-June 1975), comprised of measurements of strain, acceleration, load, and temperature, were made to determine the variations in loading that occur in the gate hoist mechanism and in the gate supports during both typical and nontypical gate operation. Tests are briefly described and a limited sampling of the data is presented.

Keywords: Locks, Hydrology, Closing structure

NEMANICK, J. M. 1973. Recolonization of macroinvertebrates on artificial substrate samples in the Mississippi River near Monticello, Minnesota. M.S. Thesis, St. Cloud St. Univ., St. Cloud, MN. 106 p.

Abstract: Artificial substrates of concrete blocks were used to obtain samples. Rate of colonization in relation to heated discharge was examimed. There were two sites of four stations with four blocks. One from each station was recovered every seven days. Therefore samples existed with 7-35 day exposure. Collections were made July through November 1971 and April through July 1972. Identifications were made to three orders: Trichoptera, Ephemeroptera and Diptera.

Keywords: Benthos, Production, Minnesota, Equipment

NEUDAHL, L. 1976. Age and growth of the major fish species in the Mississippi River near Becker, Minnesota, M.S. Thesis. St. Cloud State Univ., St. Cloud, MN. 113 p.

Abstract: This was an age and growth study of six species of fish during the summer of 1975 to establish a base-line data. A comprehensive program of scale samples, length and weight, etc. to develop growth history information. Rate of growth peaked during age three for most species. Linear regression model was adequate to express relationship between body and scale length.

Keywords: Age and growth, Fish, Survey, Minnesota, Life history

NEWLING, C. J. 1971. Waterfowl utilization of a southeast Minnesota Mississippi River backwater marsh. B.A. Thesis, St. Mary's College Winona, MN. 43 p.

Abstract: This research project was undertaken for two purposes: to collect population density data for waterfowl on small areas, and to ascertain the present natural conditions on a tract of the Prairie Island marsh, Winona, Minnesota, which is under consideration for industrialization.

Keywords: Waterfowl, Minnesota, Survey, Wetlands

NICKLAUS, R. H. 1975. A summary of 1974 Waterfowl Harvest Parameters on the Mississippi River portions of Minnesota and Wisconsin. (Mississippi River Work Unit). Wisconsin Dept. Nat. Res., LaCrosse, WI.

Abstract: The original Mississippi River hunter pressure-hunter survey was continued and expanded in 1974. Added were Pools 4 through 9, Minnesota side, and Wisconsin Pools 10 and 11 giving complete coverage on the Wisconsin side from Nelson to Dubuque. Objectives of the study were estimates of total harvest by species and season regulations evaluation. In particular, the hypothesis of no difference was to be tested involving parameters of species harvest under the point system and a four bird, two mallard/wood duck framework.

Keywords: Waterfowl, Harvest, Minnesota, Wisconsin

NICKLAUS, R. H. 1976. A summary of 1975 Waterfowl Harvest on the Mississippi River Portions of Minnesota and Wisconsin. (Mississippi River Work Unit). Wisc. Dept. Nat. Res., LaCrosse, WI.

Abstract: This is the third annual report of a planned 5-year survey of waterfowl harvest on the Mississippi River. Adjustments continue to be made in sampling sites and techniques in order to maximize efficiency in data collection. Objectives of the study are estimtes of total harvest by species and season regulations evaluation. The hypothesis to be tested is that of no difference in species harvest under the point system and a four bird, two mallard/wood duck framework.

Keywords: Waterfowl, Harvest, Minnesota, Wisconsin, Regulations

NICKLAUS, R. H. 1977. A summary of 1976 Waterfowl Harvest Para-

meters on the Mississippi River Portions of Minnesota and Wisconsin. (Mississippi River Work Unit). Wisc. Dept. Nat. Res., LaCrosse, Wisconsin.

Abstract: This is the fourth annual report of a planned 5-year survey of waterfowl harvest on the Mississippi River. The surveyed area includes the Wisconsin side of the river from Nelson south to the state line and the Minnesota side from Wabasha to New Albin. Adjustments continue to be made in sampling sites and techniques in order to maximize efficiency in data collection. Objectives of the study are estimates of total harvest by species and season regulations evaluation. The hypothesis to be tested is that of no difference in species harvest under the point system and a four bird, two mallard/wood duck framework.

Keywords: Waterfowl, Harvest, Minnesota, Wisconsin, Regulations

NIELSEN, D. N., C. R. FREMLING, R. N. VOSE and D. MCCONVILLE. 1978. Phase I Study of the Weaver-Belvidere Area, Upper Mississippi River prepared for U.S. Fish and Wildlife Service, St. Paul, MN. Contract #14-16-0003-77-060.

Abstract: GREAT three-phase rehabilitation program for Weaver Bottoms as a result of Fremling 1976. I. Environmental and engineering assessment, II. actual construction of project, III. Monitoring of environmental changes from construction. The objectives of this report is to provide a detailed physical, chemical, biological and geographical data base for evaluation of short and long term effects and to finalize habitat improvement.

Since construction of dams Weaver Bottoms has changed from backwater area of Mississippi River with marsh-like characteristics to slough-lake type. During high water approximately 30% of the river flows through this area. Belvidere area is a running slough with 20% of river flow during high water. No endangered mussel species of Lampsilis higginsii were found in the area. Emergent vegetation of Belvidere Slough is diverse and widely distributed. Weaver Bottoms lacks vegetation because of physical conditions, contains large amounts of lotus which is rapidly declining and coontail, the major species.

Keywords: Limnology, Mussels, Flood, Flow, Aquatic plants, Minnesota, Wisconsin

NORD, R. C. 1959. Fisheries survey of the Upper Mississippi River. Trans. Amer. Fish. Soc. 88(33):210-211.

Abstract: This paper briefly summarizes the work of the Upper Mississippi River Conservation Committee. The stated purpose of the committee is "to provide for the carrying on of cooperative surveys and studies of conditions of national and interstate concern affecting conservation, wildlife, and recreational interests in the Upper Mississippi River."

Keywords: Fish, Survey, Upper Mississippi River

NORD, R. C. 1960. 700 miles of river fishing. The Conservation Volunteer, Minn. Dept. of Cons., March-April, pp. 15-18.

Abstract: An evaluation of the size and nature of the fishery resource and a continued search for trends in the fishery. Studies on the river were conducted by aerial and ground surveys, and tagging to determine species and population characteristics.

Keywords: Fishing

NORD, R. C. 1964. The 1962-1963 sport fishery survey of the Upper Mississippi River. Upper Miss. River Cons. Comm. 209 p.

Abstract: Report contains condensed information pertaining to the Mississippi River sport fishery for the administration; detail for the fish biologist; and complete procedures and comparative data for fishery personnel who will repeat Mississippi River creel censuses.

Keywords: Sport fishing, Survey, Upper Mississippi River

NORD, R. C. 1967. Compendium of Fishery Information on the Upper Mississippi River. Upper Mississippi River Conserv. Comm. 238 pp.

Abstract: Initial Issuance, with annual reports.

Keywords: Fishing

NORDSTROM, G. R., W. L. PFLIEGER, K. C. SADLER, and W. H. LEWIS. 1977. Rare and Endangered Species of Missouri. Missouri Dept. Cons. and U.S. Dept. Agr. Soil Cons. Service. 129 p.

Abstract: The Department of Conservation has established a list of animal species considered endangered and provided certain statutory protection for them. Recently more extensive work has been done to complete a list of plant species also. Annotations are given describing the status, distribution and the broad ecological community in which species is normally found.

Keywords: Rare species, Endangered species, Missouri

NORVITCH, R. G., R. SCHNEIDER and R. C. GODFREY. 1963. Geology and hydrology of the Elk River, Minnesota, nuclear reactor site. U. S. Geol. Survey in cooperation with the U. S. Atomic Energy Commission.

Abstract: The objective of this report is to determine the geologic and hydrologic conditions that would affect the movement of a hypothetically spilled liquid at the Elk River, Minn., nuclear-reactor site and to evaluate the possibility of such a spill reaching a major water facility downstream along the Mississippi River.

Keywords: Geology, Hydrology, Minnesota

NOSEK, J. A. 1976. Feeding habits of several game fish and rough fish species form the Weaver Bottoms, Half Moon Lake, and Fountain City Bay Areas of the Upper Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN.

Abstract: During the summer of 1975 a stomach analysis study was conducted on several species of large fish to obtain information of their feeding habits. The study was part of an environmental investigation into the Weaver Bottoms, Half Moon Lake, and Fountain City Bay areas, pools 5 and 5A, of the Upper Mississippi River. Fish taken by means of an electrofishing boat were sacrificed and the contents of their stomachs removed and analyzed. Game fish species were found to feed predominantly on invertebrate material, showing little piscivorous activity. Rough fish similarly, had a predominantly invertebrate diet, with lesser piscivorous habits and increased feeding on microscopic food items.

Keywords: Upper Mississippi River, Pools 5 and 5A, Fish, Food habits

O'CONNELL, T. R., Jr. and R. S. CAMPBELL. 1953. The benthos of Beach River and Clearwater Lake, Missouri. Univ. of Missouri Stud. 26(2):25-41.

Abstract: This section of the Black River Studies compares the benthos in Black River, 1947, with that of the same region after impoundment by Clearwater Lake, 1948-1950. The findings are based on 54 river samples and 283 reservoir samples.

The river samples included 39 different taxonomic groups of benthic organisms. The dominant families were mayflies, midges, and riffle beetles. The average standing crop numbered 788 organisms with a dry weight of 455 milligrams per square meter. Substrates of rubble or gravel were the most productive. Riffles were almost twice as productive as pools.

Black River rated as a Grade I stream when its productivity was judged by standard criteria; when compared with some other streams on a basis of production per unit area Black River appeared average. In qualitative aspects the benthos of this smallmouth bass stream closely resembled the benthos of trout streams as described by other workers.

Trends within the reservoir, 1949-1950, included a gradual increase in standing crop and a gradual decrease in the total number of common benthic groups.

Distribution of organisms showed some correlation with depth. The deepest part of the lake, 30-50 feet, was subject to the effects of summer stagnation.

Production of bottom fauna in Clearwater Lake was poor compared with procduction reported for some natural lakes.

Keywords: Black River, Benthos, Missouri

ODLAUG, T. O. 1954. Parasites of some birds of Minnesota. An annotated bibliography. The Flicker, 26(2):59-65.

Abstract: A list of bird hosts and their parasites from Minnesota. A bibliography is also given for papers relating to parasites of Minnesota birds.

Keywords: Parasites, Birds, Minnesota

OGATA, K. M. 1975. Drainage Areas for Illinois Streams. Geological

Survey, Champaign, Ill. Water Resources Div. Illinois Inst. for Environmental Quality, Chicago. 124 p.

Abstract: Drainage areas were tabulated for all streams in Illinois which drain over 100 square miles, at sites where streamflow data have been collected, and at other selected locations. Areas were planimetered on U.S. Geological Survey topographic quadrangle maps and balanced to known areas taken from Smithsonian Geographical Tables of areas of quadrilaterals of the earth's surface. Streams are tabulated in sequence: first, the Ohio River basin, followed by the St. Lawrence River basin, and finally, the Mississippi River basin. Streams are listed in downstream order, starting at the headwaters; the rank of the stream system within each basin is indicated by indention. At sites where streamflow data had been collected, previously assigned U.S. Geological Survey eight-digit numbers are used. These numbers, which describe unique sites, increase in downstream order. All locations are identified by reference to a town, land-line location, topographic quadrangle, and county at the point where the drainage area was determined. An alphabetical index is provided.

Keywords: Ohio River, Flow, Hydrology, Survey

OLSON, K., M. S. JENSEN, and M. P. MEYER. 1974. Vegetation, land and water surface changes in the upper navigable portion of the Mississippi River Basin over the period 1939-73. Annual report. Army Corps of Engineers, St. Paul District. St. Paul, MN. 34 pp.

Abstract: The study, reported here, was conducted in response to an expressed need of the U.S. Army Corps of Engineers, St. Paul District, to identify the impact of its operation and maintenance activities on the navigable portion of the Upper Mississippi, Lower Minnesota and St. Crois Rivers to Guttenberg, Iowa. The study assignment consisted of three phases:

1) Preparation of baseline vegetation, land, and water surface maps.
2) Chart the post-1938 vegetation land and water surface changes in the floodplain of Pools 5, 5A, 6, 7, 8, 9, 10 and the Minnesota River from the head of navigation downstream and assess their relationship to man-caused changes in the drainage basin during the period 1939-1973.
3) Assessment of the pre-1941 to 1973 vegetation, land and water surface changes in Pools 5, 5A, 6, 7, 8, 9, 10 and the Minnesota River.

Keywords: Vegetation, Hydrology

OSTDIEK, J. L., G. H. SCHNEIDER and A. F. POGGE. 1971. Ecological habitats in Pool 21, Upper Mississippi River. 67 p. Report to Dept. of Army Corps of Engineers, N. Central Div., Chicago, Illinois.

Abstract: An important part of this study would involve considerations related to the environmental effects of raising water levels, deepening channels, or of combining the two methods of achieving a 12-foot navigation channel.

Suggested a survey be conducted seeking to classify, describe and evaluate the ecological habitats of Pool 21. Hopefully, this survey might serve as a pilot study for more extensive and intensive research in this as well as other pools of the upper Mississippi River.

Keywords: Habitat, Pool 21, Survey, Twelve-foot channel, Drawdown

OSTMOE, R. J. 1967. Abiotic factors effecting fish distribution in the Upper Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 26 p.

Abstract: Largemouth bass, Smallmouth bass, White bass, Rock bass, Walleye, Sauger, Northern Pike, Black crappie, and Channel Catfish were collected during the summer and fall of 1966 from pool 6 of the Upper Mississippi River using an electrical shocking apparatus. The abiotic factors of date, time, habitat, weather, bottom, temperature, depth, and current were recorded for each of the 42 collections. During each collection the number and species of the 658 fish collected was recorded. General trends were seen regarding fish distribution and certain abiotic factors. Of these, time of day and water temperature were most noticeable. It was found that fish were most abundant close to shore at night during the summer and in the afternoon during the fall. Also, the Sauger, Channel catfish, Largemouth bass, Black crappie, and Walleye tend to migrate out of shallow waters during the fall due to seasonal temperature change. Other abiotic factors discussed were current and daily weather conditions.

Keywords: Fish, Distribution, Pool 6, Survey, Upper Mississippi River

O'SULLIVAN, M. J. 1965. The spring food habits of four game fish in the Upper Mississippi River pool no. 6. B.A. Thesis, St. Mary's College, Winona, MN. 22 p.

Abstract: During the spring of 1967, four game fish species (Pomoxis nigromaculatus, Micropterus salmoides, Esox lucius, and Stizostedion vitreum) were collected, with the aid of a 220 volt AC shocker, from Pool 6 of the Upper Mississippi River in the vicinity of Winona, Minnesota. The stomach contents of 136 fish were removed by a stomach pumb, and analyzed microscopically.

Keywords: Fish, Food habits, Pool 6, Upper Mississippi River, Minnesota

OSWALT, N. R. and G. A. PICKERING. 1973. Spillway for Lock and Dam 26, Mississippi River, Missouri and Illinois: Hydraulic Model Investigation. Vicksburg Miss. 65 p.

Abstract: Tests were conducted on two models of the Lock and Dam 26 spillway to determilne discharge characteristics of the spillway, stilling basin performance, riprap requirements downstream from the structure, and gate vibration tendencies. The proposed gated structure, consisting of ten 110-ft-wide bays, will replace the existing dam. Tests to determine discharge characteristics revealed that data obtained in a previous model investigation could be used to determine discharge coefficients for the Lock and Dam 26 project. The stilling basin as originally designed resulted in unsatisfactory performance with only one gate open full. Several modifications to the basin were tested in an effort to effect better energy dissipation and spread flow downstream during single-gate operations.

Keywords: Dam, Models, Flow, Illinois, Missouri

OTT, J. D. 1973. Fluorescent dyemarking of Cyprinid minnows. (Family Cyprinidae) and other small fish for population studies in the Mississippi River near Monticello, Minnesota. M.S. Thesis, St. Cloud State Univ., St. Cloud, MN. 77 p.

Abstract: A fish collection seined from the Mississippi River consisted of 7,599 specimens. Almost 7,000 were cyprinids composing 13 species and seven genera. Sucker, perch, sunfish and trout-perch families totaled 666 fish. During July 1972 through July 1973 4 stations above heated water discharge of Monticello nuclear plant and four below were sampled. Fish were marked with a fluorescent dye visible under long-wave ultraviolet light. One-hour wait for recapture was successful while 24 and 48 hours were not.

Changes in population size estimates influenced by changes in habitats of minnows. Increase in current velocity and restricted habitat functioned to decrease population. A rank correlation of species composition from 1970 and this study was calculated and showed no significant change.

Keywords: Fish, Population, Distribution, Tagging

OTT, J. D. and C. R. FREMLING. 1969. Sand as a contributing factor in the apparent elevation of the Mississippi River flood plain. Paper presented at Miss. Riv. Consortium Mtg. July 6. LaCrosse, WI.

Abstract: Poor land management practices have caused sand to accumulate behind navigation dams constructed by the U.S. Army Corps of Engineers. The sand, silt and entrophication products are apparently slowly raising the bed of the Mississippi River. It seems likely that the rise in the river bed may increase the severity of floods for cities which are constructed wholy or partially in the Mississippi flood plain. A small island approximately 2 miles north of Lock and Dam #6 just offshort from La Moille, Minn. was studied.

Keywords: Sediment

PAHL, B. P. and T. VARCHMIN. 1969. A seasonal study of the food habits of three game fish in Pool 6 of the Upper Mississippi River. St. Mary's Coll., Winona, MN.

Abstract: During the fall season of 1968, the food habits of five game fish (Pomoxis nigromaculatus, Pomixis annularis, Micropterus salmoides, Esox lucious, and Stizostedion vitreum) were studied. The fish were collected, by means of a 200-volt AC shocker, in Pool 6 of the Mississippi River. The stomach contents of 153 fish were collected by use of a stomach pump and were analyzed with a stereoscope. The diets of white and black crappies were quite similar, with amphipods, Ephemeroptera, and Plecoptera naiads being utilized extensively. Diptera larvae were found exclusively in the crappies. Trichoptera larvae were found only in black crappies, with aquatic sowbugs appearing solely in crappies of both types. The main food item of largemouth bass and northern pike was other fish. Gizzard shad were eaten by only one fish -- a northern pike. Leeches were utilized by black and white crappies, northern pike, and largemouth bass. Walleyes were the most difficult fish to collect.

Keywords: Food habits, Fish, Pool 6

PAILY, P. P. 1974. Winter-Regime Thermal Response of Heated Streams. Iowa Univ., Iowa City. Doctoral thesis. Dept. of Mechanics and Hydraulics. Office of Water Research and Technology, Washington, D.C. 203 p.

Abstract: The one-dimensional convection-diffusion equation was solved to predict the winter-time temperature distributions and lengths of ice-free reaches in natural streams subjected to artificial thermal inputs. It was shown that the surface heat exchange between water and atmosphere could be expressed, for most practical purposes, as a linear function of the water temperature. The coefficients of the linearized heat loss model, applicable to laboratory conditions, have been developed from experiments conducted at subzero air temperatures. For determining the heat loss coefficients for field conditions, relations have been developed, describing the coefficients in terms of the meteorological parameters. Using the linearized heat loss term, a closed-form solution of the governing equation was developed to describe the temperature distributions under stable meteorological conditions and thermal discharge rates. For the general case with time-dependent climatic conditions and the thermal discharge

rates, a numerical scheme was developed for the solution of the problem.

Keywords: Thermal effluent, Models, Pollution, Hydrology

PAILY P. P. and E. O. MACAGNO. 1976. Numerical Prediction of Thermal Regime of Rivers. J Hydraulics Div ASCE, 102(3): 255.

Abstract: The thermal regime of rivers for fully mixed flow conditions is described by the one-dimensional form of the unsteady convection-diffusion equation. A numerical solution based on a predictor-corrector scheme is developed. A field investigation of the Mississippi River near Cordova, Ill., during winter is presented. The measured and predicted steady state temperature distributions in the river are compared

Keywords: Illinois, Models, Temperature, Hydrology, Thermal effluent, Pollution

PAILY, P. P., T. Y. SU, A. R. GIAQUINTA and J. F. KENNEDY. 1976. The Thermal Regimes of the Upper Mississippi and Missouri Rivers. Part One: Transient and Steady-State Computational models for the Prediction of River Therman Regimes of the Mississippi and Missouri Rivers in the Mid-Continent Area Power Pool (MAPP) Geographical Area. Iowa Univ., Iowa City, Inst. of Hydraulic Research. Mid-Continent Area Power Pool, Minneapolis, MN. 281 p.

Abstract: A computer-based, numerical model for calculations of streamwise (1-d) temperature distributions in rivers was developed, validated, and utilized to calculate the the thermal regimes of the Mississippi and Missouri Rivers within the MAPP geographical area. Part One of this report describes the transient and steady-state. Part Two, of the report the steady-state ITRM is used to compute the thermal regimes of the rivers. This is based on average hydrological and meteorological conditions for each season of the year, and based on 7-day, 10-year low-flow conditions for summer and winter. Longitudinal temperature distributions resulting from imposition of external heat loads from existing, proposed, and projected power plants along each river are computed. Locations along the rivers at which new plants of reasonably large size could be installed in accordance with existing thermal standards are identified. It is shown that the remaining heat assimilation

capacity of each river in the study reaches, above that which will be utilized by existing and presented sited future plants, is of the order of several thousand megawatts. Cost penalties incurred by using mechanical drafts wet cooling towers as an alternative to open-cycle cooling are shown to range from about 3 to 5 mills per kilowatt-hour.

Keywords: Upper Mississippi River, Missouri River, Thermal effluent, Hydrology, Pollution, Models

PALOUMPIS, A. A. and W. C. STARRETT. 1960. An ecological study of benthic organisms in three Illinois river flood plain lakes. Am. Midl. Nat., 64:406-435.

Abstract: This paper is concerned largely with the dynamics and changes in the benthic populations of three flood plain lakes located along the Illinois River near Havana, Illinois. For a number of years these lakes have been affected by sewage and industrial pollution from the Illinois River. Prior to 1926 Richardson studied the bottom fauna of the Illinois River and certain of its flood plain lakes. Two of the lakes included in Richardson's work were studied during the present investigation.

Keywords: Benthos, Invertebrates, Illinois, Ecology, Survey

PARMALEE, P. W. 1965. The Asiatic Clam (Corbicula) in Illinois. Ill. State Acad. Sci. 58(1):39-45.

Abstract: Specimens of the introduced Asiatic clam (Corbicula) were obtained at 18 collection stations located in the Ohio, lower Wabash and Mississippi rivers bordering southern and eastern Illinois. This clam has now (1964) become established throughout the lower Ohio River and has ascended the Wabash River as far as White County, Illinois. No specimens were found in the Mississippir River above Cairo. Rapid dispersion and population growth of this introduced mollusk in Illinois waters have occurred within the past four or five years.

Keywords: Clams, Illinois

PARMALEE, P. W. 1967. The fresh-water mussels of Illinois. Ill. State Mus. Popular Sci. Ser. 8 1-108.

Abstract: Historic and economic background, structure, development and growth, ecology of fresh-water mussels, and names and classification. Key for the identification of the species of mussels of Illinois.

Keywords: Mussels, Illinois, Benthos, Keys, Life history

PARR, A. D. and W. W. SAYRE. 1973a. Performance of the Diffuser-Pipe System for Discharging Condenser Cooling at the Quad-Cities Nuclear Power Station, September 1972-January 1973, IIHR Limited Distribution Report No. 15, Iowa Institute of Hydraulic Research, Univ. of Iowa.

Abstract: Since the Quad Cities Nuclear Power Station went into operation in May of 1972, the Iowa Institute of Hydraulic Research, under an agreement with the Commonwealth Edison Company, has conducted temperature surveys in the Mississippi River to determine temperature distributions in the reach downstream from where the condensor cooling water is returned to the river. The purpose of the investigation is to: (1) verify the predictions of the Iowa Institute of Hydraulic Research laboratory model tests for both the interim side-jet and diffuser-pipe discharge systems, and, (2) determine whether the diffuser pipe is performing as designed and make recommendations for re-adjusting the cross-channel distribution of the cooling water discharge if it is not.

Keywords: Hydrology, Thermal effluent, Temperature

PARR, A. D. and W. W. SAYRE. 1973b. Performance of the Diffuser-Pipe System for Discharging Condenser Cooling at the Quad Cities Nuclear Power Station, February-August, 1973, IIHR Limited Distribution Report No. 19, Iowa Institute of Hydraulic Research, Univ. of Iowa.

Abstract: This is the second in a series of semi-annual reports which presents and interprets data from temperature surveys in the Mississippi River downstream from the diffuser-pipe system which discharges the condenser cooling water from the Quad Cities Station. The diffuser-pipe system and the objectives and conduct of the temperature surveys are described in the first report of the series. During this report period, velocity as well as temperature distributions were measured 500 feet downstream from the diffuser pipe. The velocity data combined with the temperature data provides information on the distribution of excess heat load in the channel, in addition to the information on excess temperature distribution provided by

the temperature data.

Keywords: Thermal effluent, Hydrology, Nuclear power, Ecology, Limnology

PARR, A. D. and W. W. SAYRE. 1974. Performance of diffuser pipe system for discharging condenser cooling water at the Quad-Cities Nuclear Power Station (September 1973-February 1974). Limited Distribution Rept. No. 25, Iowa Institute of Hydraulic Research, Univ. of Iowa.

Abstract: This is the third in a series of semi-annual reports which presents and interprets data from temperature surveys in the Mississippi River downstream from the diffuser-pipe system which discharges the condenser cooling water from the Quad Cities Nuclear Power Station. The diffuser-pipe system and the objectives and conduct of the temperature surveys are described in the first report of the series. Velocity measurements were made during this report period in the same manner as described in the second report.

Keywords: Thermal effluent, Hydrology, Temperature

PARR, A. D. 1976. Prototype and model studies of the Diffuser-Pipe System for Discharging Condenser Cooling Water at the Quad Cities Nuclear Power Station. Thesis, IIHR, Iowa Institute of Hydraulic Research, Univ. of Iowa.

Abstract: The performance of the multiple-port, submerged-jet diffuser pipe system for discharging heated condenser cooling water from the 1600 megawatt Quad Cities Nuclear Power Station into the Mississippi River was investigated in a comprehensive set of river surveys and thermal-hydraulic model studies. The objectives of the investigation were to: (1) verify that the system was operating in compliance with temperature standards established by Iowa and Illinois regulatory agencies that apply to the Mississippi River; (2) determine the river discharge below which plant load must be curtailed in order to remain in compliance with the temperature standards; (3) study the mixing characteristics of single and multiple submerged jets discharging into shallow, flowing receiving waters; and (4) compare model and prototype data for the initial mixing region close to the diffuser pipe.

Keywords: Models, Hydrology, Temperature, Thermal effluent

PARR, A. D., and W. W. SAYRE. 1977. Prototype and Model Studies of the Diffuser-Pipe System for Discharging Condenser Cooling Water at the Quad-Cities Nuclear Power Station. Iowa Inst. of Hydraulic Research, Iowa City. Iowa State Water Resources Research Inst., Ames. Commonwealth Edison Co., Chicago, Ill. 266 p.

Abstract: The performance of the multiple-port, submerged-jet diffuser pipe system for discharging heated condenser cooling water from the 1600 megawatt Quad-Cities Nuclear Power Station into the Mississippi River was investigated in a comprehensive set of river surveys and thermal-hydraulic model studies. The diffuser-pipe system was found to be in compliance with the applicable thermal standards by a comfortable margin during all of the river surveys. The results of the study indicate that with a minor modification in the distribution of the flow from the diffuser ports, satisfactory performance in the open-cycle-mode can be achieved for river discharges as low as about 15,000 cfs. The gross behavior of the jets in the initial mixing region was found to be in rough accordance with the behavior of a momentum jet discharging into a quiescent, infinite body of water. For the most part, good agreement was obtained between prototype and model data. Based on the experimental results, the mixing zone downstream of the diffuser pipe is divided into an individual-jet region, a transition region where the jets merge, and a two-dimensional region following margins. Using generalized temperature and velocity-distribution functions for the individual jet region, relationships are derived for predicting the zones-of-passage, with respect to both cross-sectional area and flow discharge, for the region of a channel assigned to a single diffuser port. The minimum zones-of-passage, within which the temperature rise does not exceed 5F were found to occur about six port diameters downstream from the diffuser pipe.

Keywords: Illinois, Hydrology, Thermal effluent, Pollution, Models

PARSONS, J. D. and K. E. MARSHALL. 1974. The Aquatic Thermal Capsule. XIX Congress International Association of Limnology, Winnipeg, Canada, Aug. 22-29, 1974. 238 p. Freshwater Institute, Department of Environment: Winnipeg, Manitoba, Canada.

ABSTRACT: As a portion of a more comprehensive study from 1964 to 1973, thermal flux studies were made of the micro-

atmosphere phase, the aquatic phase, and the mud phase of a swamp ecosystem, 37°30' N, 89°30' W, in the mid-Mississippi River flood plain. Essentially, the aquatic phase is encapsulated in a discontinuous air-mud envelope. The energy flux of this three-phase system was considered for day-night and seasonal aspects. Lateral as well as vertical thermal flux was determined for the capsule. The vegetative mat, composed of some fourteen species of duckweed, drastically disrupted the heat absorption of the water mass and altered the thermal flux within the capsule.

Keywords: Thermal effluent, Water quality

PASVOGEL, C. H. 1962. Factors affecting the variability of Hexagenia bineata (Say) and Hexagenia limbata (Serville) Mayfly eggs. Research paper presented to Graduate Council of Winona State College. 55 p.

Abstract: During warm summer evenings mayflies emerge in droves from rivers, lakes, and streams widespread throughout most of North America. The nymphal stage of the mayfly is important since 1-2 years of the life cycle is spent in this stage. Upon emergence, the adult Hexagenia mayflies live for only 1-2 days during which time their primary function is to swarm, mate and lay eggs.

Keywords: Invertebrate, Benthos, Mayflies

PASWALK, C. 1956. Erosion and land conditions in the Rush-Pine Creek water shed. Research paper presented to Graduate Council of Winona State Teachers College. 31 p.

Abstract: Past farming practices in the Rush-Pine Creek Watershed have included too much grazing, too much small grain, and too little sod. This has tended to deplete the organic content of the soil, resulting in increased runoff. More plant growth should be encouraged and established upstream. Replanting of many hundreds of acres of trees is especially needed on rough lands. Pasture renovation, grassed waterways, and terraces are other practices needed on many slopes. Most of the cropland should be contoured and strip farmed with longer rotations and the use of more hay. Wildlife habitats should be improved and enlarged along streams and in the uplands. Runoff could be diminished and the velocity of streams reduced by adopting better land use practices upstream. Downstream flood control mea-

sures should supplement upstream conservation practices. Many detention dams, willow jetties, mechanical jetties, and dikes are needed to prevent further stream-bank erosion. The life of these stabiliztion structures depends considerably upon practices upstream.

Keywords: Geology, Hydrology, Research

PATRICK, W. H., and R. P. GAMBRELL. 1976. The effect of pH and redox potential on heavy metal chemistry in sediment-water systems affecting toxic material bioavailability. Presented at World Dredging Conf on Env Effects & Technology of Dredging, San Francisco, Jul 10-12, 1976, 579 p.

Abstract: The pH and redox potential of surface waters and sediments are important to the regulatory processes affecting the solubility of heavy metals and their distribution among various geochemical forms. Changes in pH or redox potential of a sediment-water system can result in chemical transformations of metals between geochemical forms affecting metal availability to aquatic and benthic organisms. These parameters also influence the uptake of heavy metals by plants grown on dredged materials applied to land. The influence of pH, redox potential, and sediment properties on the chemistry of selected metals in sediment-water systems and on heavy metal uptake by plants grown on sediment material is discussed.

Keywords: Sediments, Water quality, Heavy metals, Dredging

PEARSON, R. and D. E. CIN. 1976. The Great River Study - A New Perspective in River Management. U.S. Army Corps of Eng., St. Paul Dist.

Abstract: The Upper Mississippi 9-foot channel navigation project, which includes a series of 29 locks and dams between St. Louis, Missouri, and the Twin Cities of Minneapolis-St. Paul, in Minnesota, was originally constructed as a single-purpose project, that being to provide an efficient and safe commercial navigation channel for the Upper Midwest. What was not anticipated, however, were the "extra dividends" created by the pools in the form of fish and wildlife enhancement and public recreation opportunities. Unfortunately, as evidenced by the resource management problems these competing uses have brought today, only in recent years have we begun to understand the true implications and value of this complex project.

This paper addresses some of the problems which have surfaced and discusses a grass-roots partnership approach which has been set into motion by the State and Federal agencies involved to develop a management strategy for the future that considers all public demands in their proper perspective and provides for a balanced use of resources in a manner that is technically and economically sound and socially and environmentally acceptable.

Keywords: Management, Nine-foot channel, Navigation

PELREN, D. N. 1970. Age and growth of white bass from Pool 19 of the Mississippi River. Iowa State J. Sci. 44(4): 471-479.

Abstract: A study of the age and growth was made of 106 white bass, Morone chrysops (Rafinesque), collected from Pool 19 of the Mississippi River during 1966 and 1967, Log W= -5.036 + 3.063 Log L, where W = weight in g and L = total length in mm. A t-test indicated that the slope did not differ from 3.00 at the 95% confidence level. Coefficients of condition, K, were lower in December 1966 than in the summer and were higher in 1966 than 1967. Coefficients of condition did not vary with size classes. The body-scale relationship gave an intercept value of 37.6 mm, which was used when calculating length at each annulus. Only 19 of the 106 white bass had two or more annuli. Growth was slow compared with published data on other water.

Keywords: Fish, Pool 19, Age and growth, White bass

PETERSEN, W. J. 1937. Steamboating on the Upper Mississippi. St. Hist. Soc. of Ia., Ia. City.

Abstract: A history of steamboating on the Upper Mississippi River with riverboat tales and life on the Mississippi.

Keywords: Commercial boat traffic, History

PETERSON, D. E. 1969. Thermal Capacity of Mississippi River Basin. Presented at AICHE Water Sym Series 16:364.

Abstract: A three-part approach was used to determine thermal capacities of the Mississippi Basin streams.

1) a simulation of the 1964 calendar year water temperatures,
2) A steady-state heat budget model determined the maximum number of power plants with fixed

heat rejection rates that could be placed along a stream within a given temperature increment above natural background,

3) The third step was a statistical examination of long-term water temperature records to ascertain the clipping effect that State Maximum Temperature Standards may have upon cooling capacities.

Keywords: Thermal effluent, Temperature, Water quality

PETERSON, D. E. and R. T. JASKE. 1968. A Test Simulation of Potential Effects of Thermal Power Plants on Streams in the Upper Mississippi River Basin. Battelle-Northwest, Richland, Wash. Pacific Northwest Lab. 81 p.

Abstract: The 1964 thermal regimen of the Upper Mississippi River and eight major tributary streams were simulated with the COL HEAT digital model. The potential impact of 1980 and year 2000 power requirements were simulated under the assumption of flow through cooling of steam generating plants. The results indicate that by the year 2000 few, if any, plant sites will remain along the Mississippi River where flow through cooling can be exclusively utilized for 1,000 MW units.

Keywords: Upper Mississippi River, Models, Nuclear power, Hydrology, Thermal effluent

PETERSON, D. E. and R. T. JASKE. 1970. Potential Thermal Effects of an Expanding Power Industry-Upper Mississippi River Basin. Battelle-Northwest, Richland, Wash. Pacific Northwest Lab. 95 p.

Abstract: Direct cooling capacities of the main stem Mississippi River and eight major tributaries between Royalton, Minnesota and Alton, Illinois for average and low flow conditions were simulated within a temperature constraint of 5 °F above natural background. Total assimilative and dissipative capacity of the upper Mississippi Basin ranged from a high of 130 GWT to a low of 46 GWT. Analyses of projected power growth patterns indicate that the main stem has adequate cooling capacity to accommodate forecasted loads through the year 1990, except in the St. Paul-Minneapolis area. Partial recirculatory cooling facilities appear to be possible solution to tributary basin cooling water requirements beyond the year 1980.

Keywords: Mississippi River, Nuclear power, Thermal effluent

PETRICK, G. M. 1970. Quantitative determination of vitamin B-12 in six ecological surface areas of pool 6 on Mississippi River employing Euglena gracilis (Z strain) bioassay. B.A. Thesis, St. Mary's College, Winona, MN. 33 p.

Abstract: A procedure for the assay of vitamin B-12 in river water is proposed here. The method employs Euglena gracilis (Z strain) as the assay organism and uses a haemacytometer slide to count the cells after incubation. The subject area of the assay is six different lotic surface areas within Pool VI of the Mississippi River. The main hypothesis is that ecological differences in the area will cause different concentrations of the vitamin to be present.

Keywords: Pool 6, Phytoplankton, Methods

PFLIEGER, W. L. 1968. A check-list of the fishes of Missouri, with keys for identification. Mo. Dept. Cons., D-J Proj. F-1-R, Ser. 3. 64 p.

Abstract: A list of native Missouri fish with taxonomic keys for identifications.

Keywords: Keys, Fish, Missouri

PFLIEGER, W. L. 1971. A distributional study of Missouri fishes. Univ. of Kansas Mus. of Nat. Hist. 20:225-570.

Abstract: A study of the distribution of fishes in Missouri with reference to their habitat and life history.

Keywords: Missouri, Fish, Survey, Distribution

PFLIEGER, W. L. 1975. The fishes of Missouri. Mo. Dept. Cons. 342 pp.

Abstract: A guide to the native fishes of Missouri with reference to their habitat, food habits, life history, and taxonomy.

Keywords: Missouri, Fish

PIERCE, D. 1977. The problems with Locks and Dam 26. Not Man Apart 7 (Mid-June, 1977): pp.7,15.

Abstract: On May 1, the Carter Administration announced that it wants Congress to delay the proposed Locks and Dam 26 until extensive engineering studies are completed. His decision could prevent an unwise multi-billion dollar investment which would destroy the environment quality of the Illinois and Upper Mississippi River Region and the efficiency of the U.S. transportation system.

Keywords: Lock and Dam 26

PIERCE, P. W. and C. M. ELLIOT. 1967. Resume of research studies of hydraulic characteristics of Mississippi River channels. Interim Rept. FY 1967. Potam. Invest. No. 19-2. U.S. Army Engr., Waterways Exp. Sta. Vicksburg, Miss.

Abstract: This report presents a brief description of field and office studies of the hydraulic characteristics of selected cross sections and reaches of the Lower Mississippi River through FY 1966. These studies are a part of the general potamology investigations for improving techniques for stabilizing the bed and banks of the Mississippi River.

Keywords: Hydrology, Dredging, Levees, Dam

PIKE, Z. M. 1811. Exploratory travels through the western territries of North America. Paternoster-Row, London.

Abstract: Voyage from St. Louis on the Mississippi to the source of that River, and a journey through the interior of Louisiana, and the northeastern provinces of New Spain.

Keywords: History

PLATNER, W. S. 1946. Water Quality studies of the Mississippi River. U.S. Fish Wildl. Serv., Special Scientific Report No. 30. Wash., D.C. 77 pp.

Abstract: Physical and chemical data were studied in the Upper Mississippi River from 2 miles above Lock and Dam No.2 in the Hastings Pool, Minn. to Caruthersville, Mo., during the year 1944. Oxygen, nitrogen, ammonia, phosphate, chlorides, sulfates, calcium, carbon dioxide and carbonates were examined. The river tended to be increasingly acidic downstream. Bicarbonates were highest during midwinter. Percentage of sedimentation increased during high water.

Keywords: Upper Mississippi River, Chemistry, Water quality

POSTON, H. W. and W. C. GALEGAR. 1969. Pollution in the Mississippi River. AICHE Symposium Series. 65(97):33-42.

Abstract: Natural pollution remains a major concern. While it is being checked by improved flood control, navigation developments, and better agricultural practices, much remains to be done. Another major concern is the man-made pollution pouring into the water from the dozens of bustling communities along the river's banks. These wastes are the result of man's use of the water, for municipal water supplies, for agriculture, for industrial processes and cooling, for boating, for swimming, and for other recreational purposes. Municipalities are a major source of water pollution.

Keywords: Pollution

POWELL, C. J., and C. W. BRASFIELD, C. W. 1957. Old River Low-Sill Control Structure. Report 2 Studies of Riprap Placement Plans. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 28 p.

Abstract: Tests of the efficacy of three plans for riprap placement downstream of the low-sill structure were conducted on a 1:36-scale model of the structure with the various sizes (24 in., 18 in., and 12 in.) of riprap reproduced by reducing the prototype sizes by the scale ratio of 36 to 1. A series of general tests were also conducted in a glass-sided flume to determine the velocities required to move the various sizes of riprap used in the Old River plan. Model studies indicate probable failure of all proposed prototype riprap placement plans at a discharge of about 400,000 cfs with a tailwater elevation of 45.0 or below.

Keywords: Rip-rap, Models, Dam, Flow

PRATT, W. H. 1876. List of shells at Davenport, Iowa. Proc. Davenport. Acad Nat. Sci. 1 1-165.

Abstract: List of land and fresh water shells found at Davenport and whether they were abundant, common or rare.

Keywords: Benthos, Iowa, Species list

PRILL, S. D., 1977. Investigation of Fish Impingement Processes at the Burlington Generating Station. M.S. Thesis, Univ. of Iowa.

Abstract: The purpose of this thesis is to examine in greater detail the impingement processes at the Burlington Generating Station. Aspects which were considered, other than number and species of fish impinged, were; the ages of fish impinged; the physical and biological characteristics of the river; and the intake structure and plant operation processes in relation to the impingment of fish. Methods for determining the effect of impingement on the aquatic environment will also be discussed.

Keywords: Fish, Nuclear power, Iowa, Impingement

PRIOR, C. H. and J. H. HESS. 1961. Floods in Minnesota, magnitude and frequency. Minn. Dept. Cons., Div. of Waters, Bull. 12.

Abstract: Peak discharge data from 146 gaging stations are tabulated in this report. Records from all stations not materially affected by regulation or diversion and having 5 or more years of record are included. Of these records those of 10 or more years in length are used in the determination of flood-frequency relations which afford the user of the report a method of obtaining the magnitude and frequency of floods at any point in the State provided the drainage area and percentage of lake area above the point of investigation are known.

Keywords: Flooding, Minnesota

PRIOR, C. H., R. SCHNEIDER and W. H. DRUM. 1953. Water resources of the Minneapolis-St. Paul area, Minnesota. U. S. Geol. Survey Circ. 274. U. S. Geol. Survey in cooperation with the Minn. Dept. Cons., Div. of Waters and the St. Paul District, Corps of Engineers., U. S. Army.

Abstract: The purpose of this report is to summarize and interpret all available water-resources information for the Minneapolis-St. Paul area. The report will be useful for initial guidance in the location or expansion of water facilities for defense or nondefense industries and the municipalities upon which they are dependent. No attempt has been made to present a complete record of the hydrologic information for the area. The Twin Cities area, is quite large; therefore, additional investigations will be necessary to determine the availability of water supplies for large-scale specific uses.

Keywords: Hydrology, Minnesota

PRYTULA, F. T. 1968. Waterfowl availability during the spring migration in the Mississippi River of Southestern Minnesota. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: An attempt has been made in this study to collect as much data as possible on the kinds and amounts of plants and animals that might be utilized as food by migrating waterfowl during the early spring season. The plants and animals were collected from sample sites in a marsh, flooded wooded area and in open water.

Keywords: Migration, Waterfowl, Minnesota, Food habits

QUADE, H. W. Cladoceran Faunas Associated with Aquatic Macrophytes in Some Lakes in Northwestern Minnesota. Ecology. 50(2):170-170.

Abstract: The cladoceran faunas associated with 12 species of aquatic macrophytes were studied to determine if the Cladocera showed community perference to specific plants. Almost 3,000 specimens belonging to 38 species of Cladocera were counted. Forty-two collections were made in seven lakes near Lake Itasca (N.W. Minnesota). SCUBA was used to select appropriate single-species stands of the 12 plants. When all collections from each species of plant were summed from all seven lakes, some grouping was evident.

Keywords: Minnesota, Vegetation, Zooplankton, Macrophytes

RACH, J. 1977. Winter Harvest, Age, and Growth of Bluegills on Lake Onalaska, 1976-1977. Unpub. M.S. Thesis. Univ. Wis., LaCrosse,

Abstract: A creel census and an age and growth study were conducted on Lake Onalaska, Wisconsin. The lake is part of Navigational Pool 7 of the Upper Mississippi River, and provides a major bluegill fishery in Wisconsin. This study was conducted to estimate the winter harvest of bluegills and to determine their growth rate.

The creel census was based on a half-day sampling schedule in which a single clerk gathered harvest data. Car counts were used to estimate angler numbers. Census data were collected on all weekend days and on two weekdays per week. Sample data were used to project the winter harvest of bluegills.

Keywords: Age and growth, Lake Onalaska, Bluegill, Fish, Harvest

RADEMACHER, J. M. 1964. Pollution of the Waters of the Upper Missippi River and its Significant Tributarties, Minneapolis - St. Paul Metropolitan Area, Minnesota-Wisconsin. Public Health Service, Chicago, Ill. Div. of Water Supply and Pollution Control. 95 p.

Abstract: The examination of the one hundred and seven mile stretch of the Mississippi River extending from the junction with the Rum River above the Minneapolis - St. Paul Metropolitan Area downstream to the outlet of the interstate waters of Lake Pepin leads to two major conclusions: Despite the efforts of the water pollution control and construction of waste treatment facilities the effects of pollution on this stretch of water are so great as to require remedial action; certain basic problems require further study.

Keywords: Upper Mississippi River, Pollution, Water quality, Minnesota, Wisconsin

RAGLAND, D. V. 1974. Evaluation of three side channels and the main channel border of the Middle Mississippi Rvier as fish habitat. Springfield Va. prep. for U.S. Army. Eng. Waterways Experiment Station. AD-786 142.

Abstract: Fish, benthos and plankton collected during 5 seasonal samples from 1972-1973. Physical and chemical parameters were measured. Zooplankton populations were greater in side channels than main channel. No phytoplankton dif-

ferences were significant. Benthos populations were generally greater in main channel. Minnows were approximately six times greater in side channels (seining). Fish species collected by electroshocking were more dense in the side than main channel. Largemouth bass were found only in main channel.

Keywords: Fish, Plankton, Ecology, Benthos, Side channel, Main channel, Zooplankton, Phytoplankton

RAINS, B. A. and R. S. FLICK. 1972. Water Quality Monitoring on the Mississippi River has its Pitfalls. AICHE Water Sym. Series. 69:401.

Abstract: This treatise discusses the difficulties and problems associated with sampling a large stream to determine biological and chemical quality. Included information on sampling point selection, methods of sample collection, flow measurement technique, and pollution source location. Description of field equipment is given in addition to laboratory results obtained from sample analysis.

Keywords: Water quality, Survey, Ecology, Distribution

RANEY, E. C. and B. W. MENZEL. 1969. Heated effluents and effects on aquatic life with emphasis on fishes. Cornell Univ. Ithaca, N. Y.

Abstract: A bibliography with author-subject index emphasizing fishes. Included are documents which have appeared in mimeographed form. The first section is an author-title index. Each title is permuted and alphabetically indexed on each significant word. On the left margin of each page is a number; each refers to a complete listing by author and title in the second half of the book.

Keywords: Thermal effluent, Habitat alteration, Fish

RANSTROM, C. G. 1970. A survey of acanthocephalic infection in Black Crappie and Amphipod population in Pool no. 6 in the Mississippi River. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: In this study, a survey was made of definitive and juvenile stages of the acanthocephalan, Leptorhynchoides thecatus, in Black Crappie Pomoxis nigromaculatis and the crustacean Hyalella azteca in pool six of the Missippi River. An electric shocking boat was used to collect Hyalella azteca. The fish showed most acantho-

cephalan for each fish was recorded. Specific areas of the river were sampled and acanthocephalan infection of Hyalella azteca and Pomoxis nigromaculatis populations were found to be 3.6% and 81% respectively.

Keywords: Invertebrates, Parasites, Fish, Pool 6, Survey, Crappie

RANTHUM, R. G. 1969. Distribution and food habits of several species of fish in Pool 19, Mississippi River. M.S. Thesis, Iowa State University. Ames, IA. 207 p.

Abstract: Largest number of species of food organisms for fish were found in shallow river and flat habitats of pool 19. The sloughs ranked next in importance, and the channel habitat ranked lowest of all habitats.

Keywords: Fish, Food habits, Distribution, Pool 19

RANTHUM, R. G. 1971a. A study of the movement and harvest of catfish tagged in the Lower Trempealeau River and Trempealeau Bay. Wisc. Dept. Nat. Res., Bur. Fish Manage. Manage. Rept. No. 50.

Abstract: In past years, concentrations of catfish in Trempealeau Bay have been observed by Department personnel while supervising commercial contract seining operations and conducting electrofishing surveys. Catfish from the lower Trempealeau River and Trempealeau Bay were tagged and released to determine whether this unusual concentration was a distinct population restricted to the lower Trempealeau River system although the Mississippi River was freely accessible. Since the tagged catfish were a sample of a larger population, the rate and direction of movement could be generally determined from tag returns.

Keywords: Movement, Harvest, Wisconsin, Fish, Catfish, Tagging

RANTHUM, R. G. 1971b. The effects of heated effluent from the Dairland Power Plant at Genoa on Water Temperatures and Fish of the Mississippi River. Wis. Dept. Nat. Res. Div. Forest. Wildl. and Rec., Bur. Fish Manage., Manage. Rept. No. 48.

Abstract: A large volume of water is required to cool the plant's condensors. This is accomplished through a pair of pumps in each plant. The Genoa 3 pumps each have a capacity of 200 cubic feet per second and the LACBWR

pumps 71 cubic feet per second. Therefore, effluent discharge rate may vary from 71 to 542 c.f.s. depending on whether one or four pumps are in operation. The two separate condensor discharges are combined and released into the river through a single outlet. The objectives of this study were to determine the influence of the heated effluent on water temperatures in the Mississippi River and to observe the types and numbers of fish utilizing the area where thermal changes were most pronounced.

Keywords: Nuclear power, Thermal effluent, Temperature, Fish

RANTHUM, R. G. 1974a. Effects of Commercial Fishing on Winter Congregations of Catfish in Pool 7 of the Mississippi River. Wis. Dept. Nat. Res., Madison, WI. National Marine Fisheries Service, Washington, D.C. 9 p.

Abstract: Catfish in the Mississippi River have a seasonal behavioral pattern of schooling in certain deep water congregations are susceptible to harvest by commercial seining. To evaluate the significance of harvesting winter catfish congregations, information is given on: (1) The size of the harvestable catfish population and the fraction taken annually by commercial and sport fishing; (2) the size of the winter congregations and the areas which contribute fishing forming them; (3) the duration of the period when catfish are schooled in this manner; and (4) the potential harvest of the concentrations by commercial gear. Sampling the catfish population in a prescribed study area and the release of marked individuals into the population for recapture was employed to obtain this information.

Keywords: Fish, Pool 7, Population, Survey, Ice, Harvest, Commercial fishing

RANTHUM, R. G. 1974b. The Effects of a Commercial Gill Net Fishery on the Fish and Waterfowl of Pool 7, Mississippi River. Wis. Dept. Nat. Res., Madison, WI. Bur. Fish Wildl. Manage. National Marine Fisheries Service, Washington, D.C. 93 p.

Abstract: The results of a two-year investigation of commercial gill netting on one Mississippi River pool indicates that certain losses of non-commercial fish and waterfowl are a definite consequence of this fishery. In summary, the probability of an optimum ratio of commer-

cial to non-commercial catch declines with an expanding fishery. Some method of regulating the gill next fishery to keep non-commercial and waterfowl losses within limits tolerable to sporting interests while also providing for utilization of the commercial resource would appear to be the best management approach.

Keywords: Fish, Pool 7, Waterfowl, Fish management, Management, Regulations

RANTHUM, R. G. 1975a. Five-year summary of Mississippi River special tailwater creel census in Pool 7, 1969-1973. Wis. Dept. Nat. Res. Bur. Fish Wildl. Manage. Manage. Rept. No. 90.

Abstract: A creel census was conducted in the tailwaters of Pool 7 during March and April for five consecutive years (1969-1973) to evaluate the fishing pressure and harvest during a two-month period previously closed to fishing for large game fish. The five censuses were conducted under the auspices of the Fish Technical Section of the Upper Mississippi River Conservation Committee as part of a plan to maintain a continuing evaluation of the sport fishery.

Keywords: Creel Census, Pool 7, Tailwater, Harvest, Pressure

RANTHUM, R. G. 1975b. A summary of three 12-month creel censuses of the Pool 7 sport fishery conducted at 5 year intervals between April 1, 1962 and March 31, 1973. Wis. Dept. Nat. Res. Manage. Bur. Fish Wild. Manage. Manage. Rept. No. 83.

Abstract: A 12-month survey of sport fishing on seven navigation pools selected from the 27 pools making up the Upper Mississippi River and St. Louis, Missouri, is conducted once every five years by the conservation agencies of the five states bordering the river. Wisconsin, Illinois, Iowa, Minnesota, and Missouri are organized into an Upper Mississippi River Conservation Committee to coordinate such scientific investigations of MississippiRiver resources. Wisconsin's contributions to this recurring survey was a creel census of Pool 7 conducted from April 1, 1972 through marck 31, 1973. Pool 7 includes an 11-mile stretch of river with 11,031 acres of surface water at normal water level. Similar surveys were conducted in 1962-63 and 1967-68, and their results were compared with this most recent census to determine what changes may be occurring in the Pool 7 fishery.

Keywords: Creel census, Pool 7

RANTHUM, R. G. 1976. An evaluation of the status of the commercial fishery for catfish in Wisconsin boundary waters, Mississippi River. Wis. Dept. Nat. Res. Bur. Fish. Wildl. Manage. Manage. Rept. No. 91.

Abstract: Considerable fluctuations in the annual commercial catch of catfish from certain Mississippi River pools with important catfish fisheries aroused concern that overfishing might be resulting in below optimum harvest. Overfishing occurs when an excessive rate of fish removal (1) reduces the productive capacity of the population to a level where insufficient numbers of young fish can be produced to provide the maximum sustained harvest; or (2) decreases the age and size of the fish available for harvest below that point where the maximum rate of net weight gain (growth minus mortality per unit time) is realized; or (3) a combination of both conditions. In general the commercial catfish fishery is more intensive in Iowa-Wisconsin and Iowa-Illinois boundary waters of the Mississippi River than upstream in Wisconsin-Minnesota waters.

Keywords: Commercial fishing, Wisconsin, Harvest, Catfish, Regulations

REESE, J. G. 1973. Bald Eagle Migration Along The Upper Mississippi River in Minnesota. Loon 45 (1) 22-23

Abstract: A recording of the authors sightings of bald eagles in Wabasha and Winona Counties, Minnesota. The southward migration of bald eagles, hawks, and common crows was recorded on November 13 and 21.

Keywords: Upper Mississippi River, Minnesota, Eagle, Birds

REHDER, D. 1963. Ice fishing - Mississippi style. Iowa Conserv., 22(1):1-6.

Abstract: Ice fishing is a very popular sport with almost as many fishermen as in the summer. Northerns, walleye, bass, and a number of panfish are all caught regularly through the ice. Most of the fishermen dress warmly in insulated underwear, warm outer clothing and insulated boots. Windbreaks or shelters are used but are not common.

Keywords: Sport fishing, Ice

REHDER, D. 1964. The Mississippi--great fishing hole. Iowa Conserv., 23(6).

Abstract: The Mississippi River along Iowa shores provides excellent fishing. Over half of the angling activity will be found below the lock and dam in the first mile. Studies also show that fish taken from the river will run 39% panfish, 16% walleye, 13% white bass, 11% sheepshead, and 8% catfish.

Keywords: Sport fishing

REINHARD, E. G. 1930. The plankton ecology of the Upper Mississippi (Minneapolis to Winona). Ph.D. Thesis, Univ. of Minn., Minneapolis, MN.

Abstract: A survey of the Mississippi River was undertaken early in 1928 by the Minnesota Department of Health in cooperation with other agencies in order to ascertain the extent, character, and effect of pollution, and to determine what measures should be taken to remedy the situation. The program for the investigation, besides including a study of the river from a sanitary engineering viewpoint, was designed to bring together corroborative information from bacteriological, chemical, bio-chemical, and biological investigations conducted at the same time.

The chief purposes of this paper are to present a general picture of the plankton of the upper Mississippi, the relative abundance and seasonal distribution of the constituent organisms, the ecological factors which operate to influence the normal routine of plankton life, and statistical methods of some of the basic principles which underlie the amazing and complex phenomena exhibited by the plankton of a typical though polluted stream.

Keywords: Upper Mississippi River, Plankton, Ecology, Minnesota

REINHARD, E. G. 1931. The plankton ecology of the Upper Mississippi, Minneapolis to Winona. Ecol. Monogr. 1(4):395-464.

Abstract: A study of the phytoplankton of the river prior to canalization from Minneapolis (pool 2) to Winona (pool 16). Generally it was composed of about 70 percent diatoms, 6 percent blue-green algae and 3 percent green algae. The remaining organisms were protozoans and microcrustaceans.

Keywords: Upper Mississippi River, Minnesota, Plankton, Ecology, Protoza, Phytoplankton, Zooplankton

REYMAN, J. A. 1975. An ecological-historical survey of the Mississippi River. Amer. Biol. Teach., 37(2):94-97.

Abstract: The St. Paul new city school environmental studies class organized an in-depth study of the Mississippi River to bring together physical, intellectual, and social dimensions into a single, continuous experience for students. Objectives and sampling projects in the program are described.

Keywords: Survey, Water quality, History

RHODES, R. The Mississippi. Playboy. Vol. 19 (12) December. p. 178.

Abstract: A general description of the Mississippi; its size, history, pollution and future.

Keywords: Pollution, History

RICH, A. J. 1954. Some limnological conditions of Lake Winona during the 1953-1954 winter season. B.A. Thesis, St. Mary's College, Winona, MN. 28 p.

Abstract: The purpose of this study was an investigation of some limnological conditions of Lake Winona for the winter of 1953-54. Conditions particularly noted were dissolved oxygen, dissolved carbon dioxide, pH, and dissolved carbonates. Observations were also made of snowfall, ice thickness, and water temperature. This study was planned to supplement data amassed during the 1953 survey by the Minnesota Department of Conservation.

Keywords: Limnology, Lake Winona, Minnesota

RICHARDSON, R. E. 1921. Changes in the bottom fauna of the middle Illinois River and its connecting lakes since 1913-1915 as a result of the increase, southward, of sewage pollution. Ill. Nat. Hist. Surv. Bull. 14(4):33-75.

Abstract: The following short account of the principal changes that have occurred both in the composition and abundance of the small bottom-invertebrate fauna of the Illinois River system between Chillicothe and Browning since

1913-1915--these points being respectively 146.5 and 229.5 miles below the mouth of the Chicago River--is based on hauls made in July, August, and September, 1920, with the Petersen quantitative bottom-sampler at seventy-one stations in the river and Peoria Lake between Chillicothe and the head of Grand Island, and at twenty-five stations in five of the more important bottom-land lakes in the neighborhood of Havana.

Keywords: Benthos, Pollution, Illinois River, Population

ROBBINS, C. and J. A. MARTIN. 1976. Population doses from liquid effluents into the Mississippi River Basin. Twenty-first Annual Meeting of the Health Physics Society: Abstracts of papers. In Health Physics, 31(6): 529, Dec. 1976.

Abatract: Population doses due to the ingestion of drinking water and fish taken from the Mississippi River, resulting from nuclear power plant liquid effluents, were calculated using the RVRDOS code. Effluents from five facilities operated in 1973 were considered. Volume flow rates, radioactive decay and daughter product in-growth, and volumes of dams were considered in the dispersion calculations. Dose factors for the standard man were used. Commercial and sport fish catches and population consuming river water were compiled for the Illinois, Missouri and Mississippi rivers from the sources to the Gulf of Mexico. Doses to four body organs were calculated. In 1973, the whole body population dose was calculated to be 13 person-rem, about eighty percent of which was due to the effluents from one facility.

Keywords: Population, Effluent, Nuclear power

ROBINSON, D. 1959. Commercial Fishing Statistics - Iowa Waters of the Missouri River - 1958. Iowa Cons. Comm., Quart. Biol. Repts. 9(2):30-32.

Abstract: Commercial fishermen licensed 542 items of gear for use in the Iowa waters of the Missouri River in 1958. This This included 210 residents of Iowa and four non-residents.

Keywords: Commercial fishing, Iowa

ROBINSON, J. W. 1969. The 1969 Upper Mississippi River dredge spoil survey from Hastings, Minnesota to Cairo, Illinois. Publ. by Upper Mississippi River Conservation Committee.

Abstract: The objectives were to determine good and bad effects of the current disposal program, evaluate the present dredge spoil sites, "to assess the beneficial potential of the dredge-spoil program and to evaluate the dredge spoil sites proposed in the 12-foot channel study."

The strongest suggestion of the report was for interaction between the state and the dredgers, because they (dredgers) only consider navigation when and where they dump the dredged material.

Keywords: Dredging, Spoil, Survey, Upper Mississippi River, Twelve-foot channel

ROBINSON, J. W. 1970. Upper Mississippi Dredge Spoil Survey (1969) from Hastings, Minnesota to Cairo, Illinois. Upper Mississippi River Conservation Committee.

Abstract: The deposition of dredge spoil can cause changes in river environment to the detriment of fish and wildlife. Recommendations for dredge spoil disposal were made for Upper Mississippi River from Mile 0 (junction with Ohio River) to mile 819 (above Hastings, Minnesota).

Keywords: Fish, Disposal, Habitat alteration, Dredging

ROBINSON, J. W. 1972a. Population sampling of commercial fish. Final Rept. Mo. Dept. Conserv. D.-J. Proj. No. 4-3-R-7, Work Plan No. 21, Job No. 2. 28 pp.

Abstract: The objective of this study was to obtain quantitative information on the age and growth of the fish population and species composition of the catch. Additional information was sought regarding the use and effectiveness of various gear types. Because the area selected for study was the Mississippi River below St. Louis, the effects of municipal and industrial pollution on fish populations could also be examined in this reach of the river. Sampling stations were selected in the vicinity of Crystal City, Cape Girardeau, and Caruthersville, Missouri. A comparison of carp age and growth data was made at Hannibal and Crystal City. These fish were collected for a study of the palatability of Missouri fish.

Keywords: Fish, Population, Age and growth

ROBINSON, J. W. 1972b. Population Sampling of Commercial Fish in Waters open to commercial fishing. Trial Report. State

of Missouri, Fisheries Research.

Abstract: Quantitative information regarding age and growth of the fish population and the species composition of the Mississippi River below St. Louis.

Keywords: Fish, Commercial fishing, Survey, Sampling, Biological alterations

ROBINSON, J. W. 1973a. Research and Management of Commercial Fisheries in Missouri; Population Sampling of Commercial Fish in the Mississippi River. Mo. Dept. Cons., Jefferson City. National Marine Fisheries Service, Washington, D.C. 52 p.

Abstract: In 1967-1969, at least 4,400 fish representing 44 species were collected from the Mississippi River. Trammel nets, gill nets, hoop nets, trot lines, seines, and electrofishing gear were used. All fish were identified to species; counted; length and weight was recorded; and scale samples were collected. Eight species of fish (river carpsuckers, carp, smallmouth buffalo, bigmouth buffalo, freshwater drum, channel catfish, flathead catfish, and blue catfish) represented by 1,607 individuals, were aged. There was no one area in which fish growth was consistently better than in any other area.

Keywords: Fish, Missouri, Population, Commercial fishing, Equipment

ROBINSON, J. W. 1973b. Collection and compilation of commercial fisheries harvest data in Missouri: 1965-1971. NMFS Proj. No. 4-3-R-8, Work Plan 21, Job No. 2. Mo. Dept. Cons. 37 pp.

Abstract: The objective of this study was to compile data relating to the commercial fisheries of Missouri from 1965-1971. This was done to document the size and value of the industry during this period.

Keywords: Commercial fishing, Harvest, Missouri

ROBINSON, J. W. 1974. Collection of commercial fisheries harvest data, 1972. NMFS Proj. No. 2-199-R-1, Study A, Job 1. Mo. Dept. Cons. 10 pp.

Abstract: The objective of this job was to collect and compile data pertaining to the commercial fisheries of Missouri in order to document the size and value of the industry

in 1972. These fisheries include commercial fishing in the Mississippi, Missouri, and lower St. Francis rivers and the production of fish for food and bait. Data were obtained from monthly and annual reports of the river commercial fishermen and from the annual reports of fish farming permit and fish hatchery permit holders.

Keywords: Commercial fishing, Harvest, Missouri

ROCK, L. F. 1963. 1962 Mississippi River sport fishing creel census. Ill. Dept. Cons., Div. of Fisheries, Springfield, IL. 92 pp.

Abstract: The 1962 survey was initiated under the auspices of the Fish Technical Committee of the Upper Mississippi River Conservation Committee. Conservation agencies from the States of Illinois, Iowa, Minnesota, Wisconsin and Missouri, and the United States Fish and Wildlife Service conducted a coordinated sport fishery creel census.

Illinois censused Pools 13 and 26 from April 1 through October 31, 1962. Concurrent with the creel census, Illinois personnel performed catch studies in Pool 13 amd 26 for data relative to species lengths and weights. Illinois personnel also participated in three holiday aerial flights over Pools 12 through B-26 for information concerning recreational usage.

Keywords: Sport fishing, Creel census, Illinois

ROGERS, G. E. 1973. Vertical burrowing abilities of sphaeriid clams in Pool no. 19, Mississippi River. M.S. Thesis, Iowa State University, Ames, IA. 39 p.

Abstract: This project was initiated in response to a proposed barge harbor and access channel for Pool 19, Mississippi River, in the vicinity of Fort Madison, Iowa. Field work was conducted on the pool during the summer of 1972.

The purposes of the study were to determine whether sphaeriid, or fingernail clams can burrow upward through substrates placed upon them, and to correlate vertical burrowing abilities of sphaeriid clams to the particle size and depth of the added substrates.

Keywords: Benthos, Pool 19, Iowa, Clams, Movement, Fingernail clam

ROGERS, G. E. 1976. Vertical burrowing and survival of Sphaeriid clams under added substrates in Pool 19, Mississippi River. Iowa St. Jour. Res. 51(1):1-12.

Abstract: An experimental study was conducted to determine whether sphaeriid clams can burrow upward through substrates placed upon them and survive. Sections of the river bottom containing large numbers of Sphaerium transversum and S. striatinum were isolated, and various depths of three types of substrate--sand, silt, and a sand-silt mixture--were placed upon them. Adult clams showed poor survival with added sand and somewhat better survival with the addition of silt or the sand-silt mixture. Survival of adult clams of both species was inversely related to both particle size and depth of added substrate. Juvenile clams had higher survival rates than adults.

Keywords: Clams, Pool 19

ROGERS, J. P. and L. J. KORSCHGEN. 1966. Foods of lesser scaup on breeding, migration and wintering areas. J. Wildl. Manage., 30:258-264.

Abstract: This food habits study was based on stomach contents of 164 lesser scaups Aythya affinis 39 from a breeding area in Manitoba, 88 from a fall concentration area on the Mississippi River in Illinois, and 37 from two wintering areas on the Louisiana coast. Animal foods made up the bulk of the diet of all three groups: 91.1 percent on the breeding area, 93.5 percent on the fall concentration area and 63.7 percent on the wintering areas. The most important animal foods were amphipod crustacean on the breeding area, mollusks on the fall concentration area, and fishes on the wintering areas. The percentages of animal foods are similar to those found in other recent investigations, but they differ from earlier findings which show the less scaup to be chiefly vegetarian. Additional collecting is needed especially in early spring, for a more accurate picture of seasonal food habits but present information shows that lesser scaups feed chiefly, and sometimes almose exclusively, on animals most of the year. Animal foods decrease in the diet from summer to winter and probably reach a low point in late winter and early spring. Food habits data reflect the close relationship of the lesser and the greater scaup and show that they differ sharply from other North American members of their genus, which are chiefly vegetarians.

Keywords: Waterfowl, Migration, Food habits, Ducks, Lesser scaup

ROSENBERG, M. L., K. K. HAZLET, J. SCHAEFER, J. G. WELLS, and R. C PRUNEDA. 1965. Shigellosis from swimming. J. Am. Med. Assoc. 236 (16): 1849-1852.

Abstract: In August 1974, 31 of 45 cases of Shigella sonnei in Dubuque, Iowa, were traced to swimming in an 8-km stretch of the Mississippi River. Comparison of the first case in each affected family with neighborhood controls showed a significant correlation between swimming and illness ($p<.0001$). A significant association between diarrheal illness and swimming ($p<.0001$) was also demonstrated by a retrospective survey of 60 families who had camped at a park beside the river; the attack rate for swimmers who got water in their mouths while swimming was 18%. They had been swimming in water where the mean fecal coliform count was 17,500 organisms per 100 ml; the federal recommended upper limit for swimming water is 200 per 100 ml. A water sample obtained at the park swimming area one month after authorities had banned swimming in the area yielded S. sonnei with the same antibiogram, colicin type, and phage type as the isolates from six swimmers. This study demonstrates for the first time that shigellosis--a disease that can be caused by the ingestion of only 10 to 100 organisms--can be contracted by swimming in polluted water.

Keywords: Bacteria, Disease, Pollution

ROSLIEN, D. J. 1964. Occurrence of Haemoprotroterus nettionis in wood duck (Aix sponsa). Proc. Iowa. Acad. Sci. 71:235-240.

Abstract: The protozoan Haemoproteus nettionis was found in 77 of 168 wood ducks (Aix sponsa L.) life-trapped on the Upper Mississippi River Wildlife and Fish Refuge in September, 1963. No parasitemia was found in 68 wood ducks live-trapped in July and August, 1959 at the Union Slough National Wildlife Refuge in north-central Iowa.

A description of the parasite from woods ducks on the Upper Mississippi Refuge is presented.

Keywords: Ducks, Parasites, Protozoa

ROSS, H. H. 1944. The caddisflies, or Trichoptera, of Illinois. Ill. Nat. Hist. Surv. Bull 23(1):1-326.

Abstract: Biology, habitat preference, distribution, collecting

and preserving and classification. Key to the families is included.

Keywords: Invertebrates, Illinois, Caddisflies, Keys, Life history, Distribution

RUDDER, C. L., C. J. REINHEIMER, and J. L. BERRY. 1972. Aerial surveillance spill prevention system. EPA Env Protection Technology Series Report EPA-R2-72-007. 122 p.

Abstract: An aerial surveillance system consisting of four Hasselblad cameras and a Zeiss RMK 1523 camera was evaluated for remote detection of real and potential spills threatening inland waterways. Twenty-three multiband and baseline missions were flown over oil refineries and other industrial sites adjacent to the Mississippi River. Spills, effluents, and waste areas were identified on the multiband imager, normal and false color imagery were used to determine the best film/filter combinations for areas of interest.

Personnel, equipment, and procedures required to implement an aerial surveillance spill prevention system were determined.

Keywords: Pollution, Hydrology, Remote sensing

RUHE, R. V. 1973. Background of model for Loess Derived Soils in the Upper Mississippi River Basin. Soil Sci 115(3): 250-253.

Abstract: The loess province of the Upper Mississippi River Basin has repetitive soil-geomorphic patterns. Loess thins systematically from a major source area, and as it does so, soils formed on the loess have progressively greater development. Many studies have been made, but the explanations of soil formation continue in argument. The background of the studies and the arguments in the literature are indexed by subject matter and may be useful to students.

Keywords: Upper Mississippi River, Sediment, Models

RUSSO, E. P. 1976. Flow of pollutants through a lock. J. Waterways Harbors & Coastal Engineering Div-Asce, 102(2): 267-273.

Abstract: The extent of the flow of pollutants through a lock is investigated by USACE at a Mississippi River lock in situ measurements and bottle samples for laboratory analysis of DO, water temperature, conductivity, and pH are conducted. Diffusion coefficients are predicted. However, due to analysis assumptions and the inherent variability of field measurements, the diffusion coefficients are considered only rough estimates of the actual values.

Keywords: Lock, Pollution, Flow, Models, Temperature

SANDERSON, G. C., F. C. BELLROSE and R. CROMPTON. 1974. Waterfowl censuses on the Mississippi River from St. Louis, Missouri to Cairo, Illinois, December 6, 1973 through April 2, 1974. Ill. Nat. Hist. Surv. 21 p.

Abstract: A progress report on waterfowl censuses based on a series of flights made from St. Louis to Cairo. These reports were submitted to the U.S. Army Corps of Engineers, St. Louis District.

Keywords: Waterfowl, Survey, Missouri, Illinois

SANDERSON, G. C., F. C. BELLROSE and R. CROMPTON. 1975. Waterfowl censuses on the Mississippi River from St. Louis, Missouri to Cairo, Illinois, December 4, 1974 through March 26, 1975. Ill. Nat. Hist. Surv. Report to the U.S. Army Corps of Engineers, St. Louis District.

Abstract: Progress report from December 1974 through March 1975 of waterfowl sighted from aerial flights. Tables present numbers of species found.

Keywords: Waterfowl, Illinois

SANDERSON, G. C., F. C. BELLROSE and R. CROMPTON. 1976. Waterfowl censuses on the Mississippi River from St. Louis, Missouri to Cairo, Illinois, November 19, 1975 through April 12, 1976. Ill. Nat. Hist. Surv. Report to the U.S. Army Corps of Engineers, St. Louis District. 3 p.

Abstract: Flights were made from November 1975 through April 1976 to assess the waterfowl populations along a stretch of the Mississippi River

Keywords: Waterfowl, Illinois

SANDERSON, G. C., F. C. BELLROSE and R. CROMPTON. 1977. Waterfowl censuses on the Mississippi River from St. Louis, Missouri to Cairo, Illinois, October 28, 1976 through April 13, 1977. Ill. Nat. Hist. Surv. Report to the U.S. Army Corps of Engineers, St. Louis District. 4 p.

Abstract: The numbers of different species of waterfowl were studied during a census on the Upper Mississippi River.

Keywords: Waterfowl, Illinois

SANDERSON, G. C., F. C. BELLROSE and R. CROMPTON. 1978. Waterfowl censuses on the Mississippi River from St. Louis, Missouri to Cairo, Illinois, November 4, 1977 through April 12, 1978. Ill. Nat. Hist. Surv. Report to the U.S. Army Corps of Engineers, St. Louis District. 4 p.

Abstract: Part of a series of progress reports prepared for the U.S. Army Corps of Engineers to study waterfowl populations from St. Louis to Cairo.

Keywords: Waterfowl, Illinois

SARAPOO, W. F. 1977. Production of a stream caddisfly (Hydropsyche phalerata, Hagen) in the Mississippi River near Monticello, MN. M.S. Thesis, St. Cloud Univ., St. Cloud, MN.

Abstract: Production estimates were obtained by the Allen curve method and the modified Winberg method for Hydropsyche phalerata larvae in the Mississippi River from May 25, to November 22, 1976. A total of 45,759 larvae were examined, after subsampling, to determine the head capsule size of instars 2 to 5, mean individual weight of each instar, and mean standing crop of each instar.

The Allen curve method yielded a production estimate of 39.61 gm-2 for the June 24 - September 22 sampling period, and the modified Winberg method gave an estimate at 16.59 gm-2 for the same time period. The coefficients of determination (r2) obtained from Pearson correlation coefficients for the two methods was 0.6022. The low river flow in 1976 affected the production estimates by concentrating the larvae in the river because of decreased available substrate for colonization, and by raising the ambient temperature of the river. Statistical analyses to determine the effect of the thermal effluent from the Northern States Power Company Monticello Nuclear Generator were based on production estimates from the nonheated and heated zones. The heated effluent did not affect the number or biomass of the Hydropsyche phalerata population.

Keywords: Invertebrates, Benthos, Minnesota, Production, Caddisflies, Habitat alteration

SATEK, B. A. 1948. Summary of catfish tagging experiment. UMRCC Ivest. Rept. No. 22. 2 pp.

Abstract: A total of 3500 channel catfish have been tagged to date. Twenty-three hundred of these were tagged at Lansing and transported to be released at Lake City in central Lake Pepin on September 29, 1947. Seven hundred were tagged at various locations in Lake Pepin during August and September, 1947. Five hundred were tagged and released at Reads Landing immediately below Lake Pepin in March 1948.

One hundred and eleven returns have been received: 24 from the Lansing fish, 68 from the Lake Pepin fish, and 19 from the Reads Landing fish.

Keywords: Fish, Survey, Catfish, Tagging

SAYRE, W. W. and A. D. PARR. 1974. Summary of thermal monitoring results for Quad-Cities Generating Station (September 1972 through January 1974). University of Iowa Institute of Hydraulic Research, IIHR Limited Distribution Rept. No. 26.

Abstract: A summary of temperature data in the Mississippi River downstream from the diffuser-pipe system. This data provides information on the distribution of excess heat load in the channel.

Keywords: Temperature, Thermal effluent, Nuclear power

SAYRE, W. W., K. D. TRACY and D. B. MCDONALD. 1975. Investigation of Wastewater Outfall for Clinton Film Plant: Assessment of Chemical Impact and Analysis of Physical Mixing Characteristics of Beaver Slough. Iowa Institute of Hydraulic Research, Univ. of Iowa, Iowa City, Iowa. Prepared for E.I. DuPont Nemours & Co. 84 pp.

Abstract: In conjunction with the installation of a new industrial wastewater treatment system at DuPont's Clinton Film Plant, a comprehensive investigation was conducted to assess the chemical impact of the highly-acid wastewater discharge on the water quality of Beaver Slough of the Mississippi River. The investigation included: (1) an analysis of hydrologic records and hydrographic surveys to determine characteristics of the flow in Beaver Slough; (2) temperature and pH surveys to determine the mixing characteristics of the slough and the existing outfall structure; (3) a theoretical and laboratory study of the natural buffering mechanisms and chemical equilibrium relationships for the slough;

and (4) preliminary design of an outfall structure consisting of a multiple-point, submerged-jet diffuser system.

Keywords: Chemistry, Slough

SCALES, E. H. and J. D. YARBROUGH. 1975. Endrin uptake in Insecticide-resistant and susceptible mosquitofish (Gambusia affinis). J. Agric. Food Chem., Nov.-Dec. 1975, 23(6): 1076 (4).

Abstract: Brain liver, and tissue concentrations of mosquitofish exposed to 10 and 1500 ppb of endrin over various time periods were measured. Insecticide resistant fish generally showed lower concentrations than susceptible fish did. Except in cases exhibiting symptoms of endrin poisoning. Insecticide resistance in most mosquitofish appears to be caused by a less sensitive target site in those fish.

Keywords: Pesticides, Fish, Toxicant

SCHADE, B. 1975. Statement on behalf of Minnesota Pollution Control Agency. Minnesota Pollution Control Agency. Presented at EPA Natl. Conf. on PCB's, Chicago, Nov. 19-21, 1975. 373 p.

Abstract: The Minnesota Pollution Control Agency, charged with administering and enforcing all laws relating to the pollution in the state, supports a federal ban on the sale and use of PCB's. Significant PCB concentrations have been identified within the Mississippi River near the border areas of Minnesota-Wisconsin known as Lake Pepin, and the public was advised to limit consumption to no more than one meal per week of fish taken from the Minneapolis-St. Paul metropolitan and Lower Lake Pepin areas.

Keywords: Pesticides, Minnesota, Wisconsin, Lake Pepin, Chlorinated hydrocarbons

SCHAFER, M. L., J. T. PEELER, W. S. GARDNER and J. E. CAMPBELL. 1969. Pesticides in drinking water: Waters from the Mississippi and Missouri rivers. Environ. Sci. Tech. Washington, D.C., 3(12):1261-1268.

Abstract: Over 500 grab samples of finished drinking water and related raw water were assayed for 10 organochlorine

pecticides, their metabolites, and related compounds. The samples were collected between March 1964 and June 1967 from 10 selected municipal finished water supplies whose source was either Mississippi or the Missouri River. Both 100-ml. and 1-gallon samples sizes were assayed. Included is a statistical evaluation of the one-step extraction method using 1-gallon samples to which known amounts of the 14 compounds were added at levels ranging from 0.06 to 5.0 ppb. Over 40% of the finished water samples contained detectable dieldrin and more than 30% contained detectable endrin p, p'-DDT, and p, p'-DDE. Twenty percent of the 63 samples assayed for chlordan contained detectable concentrations; five of these were in excess of 0.25 ppb Aldrin, HCE and heptachlor were found only occasionally. No toxaphene nor methoxychlor was detected.

Keywords: Pesticides, Missouri River, Water quality

SCHERER, H. P. 1970. A fish study on the Mississippi River at Monticello, Minnesota. M.S. Thesis, St. Cloud State Univ., St. Cloud, MN. 74 p.

Abstract: This was the fish portion of a baseline study for the Monticello Nuclear Plant. Species makeup and migration patterns were determined. Evaluations of indices of physical conditions were made. Use of microhabitat by various species was analyzed.

Keywords: Fish, Survey, Nuclear power, Minnesota, Migration, Habitat

SCHNEBERGER, E. 1949. Report of the committee on pollution. Trans. Am. Fish. Soc., Vol. 79, p. 278.

Abstract: A series of brief summaries of papers presented to the Society on various aspects of pollution.

Keywords: Pollution

SCHOLLMEIER, M. E. 1975. Qualitative parasitic infections in the intestines of ducks of the Upper Mississippi Flyway in Fall 1974. B.A. Thesis, St. Mary's College, Winona, MN. 12 p.

Abstract: During the fall of 1974 a project was undertaken to qualitatively determine the percentage and kind of parasitic infections within the intestines of ducks commonly found in the Upper Mississippi Flyway.

Keywords: Parasites, Ducks, Upper Mississippi River

SCHOOLCRAFT, H. R. 1834. Narrative of an expedition through Upper Mississippi to Itasca Lake. Harper and Bros., New York. 307 p.

Abstract: The initial objective of his expedition was to proceed into the Chippewa County and put an end to the hostilities between the Chippewas and Sioux. This book describes his journey through the Mississippi Valley to locate the Chippewa and Sioux tribes.

Keywords: History

SCHOUMACHER, R. 1962. Mississippi River fishery investigations in Iowa. Iowa Cons. Comm., Quart. Biol. Repts., 14(2):14-17.

Abstract: The Mississippi River bordering Iowa supports a sizeable sport and commercial fishery. Past work on the river by Iowa has included creel census, exploratory fishing, and life history studies. Present studies consist of an intensive creel census on pools 11 and 18, in cooperation with the Upper Mississippi River Conservation Committee, limited exploratory fishing, and studies on walleye and sauger life histories. Walleye eggs were collected from the river for the first time this spring by Iowa biologists. Commercial fishing statistics are, and will continue to be, collected and tabulated.

Keywords: Fishing, Iowa, Research

SCHOUMACHER, R. 1963a. Life history studies: Iowa, walleyes and sauger. (Mimeo.) UMRCC Proceedings 19:80.

Abstract: Life history studies were conducted on sauger and walleye in Iowa waters. Distribution, breeding and spawning are described.

Keywords: Life history, Iowa, Fish, Walleye, Sauger

SCHOUMACHER, R. 1963b. A preliminary investigation into the cause of the decline in the commercial catch of catfish in the Iowa waters of the Mississippi River. Iowa Cons. Comm., Quart. Biol. Repts., 15(1):20-25.

Abstract: Commercial fishing statistics collected by the Iowa Conservation Commission have indicated that the catfish catch has declined since 1960. A letter and questionnaire concerning the catfish fishery were sent to the 390 Iowa fisherman on the river. One hundred twenty-one (31%) responded most of them saying that they believe there has been a decline in catfish within the last four years. Most respondents said that there have been large numbers of small catfish in the river in the last few years. Pollution and overfishing were cited most often as the cause of the decline. Field investigations will be undertaken this year to collect information on the catfish population structure in various pools in the river.

Keywords: Commercial fishing, Fish, Iowa, Catfish, Population, Biological alterations

SCHOUMACHER, R. 1963c. Results of a walleye and sauger tagging study in the Iowa waters of the Mississippi River. Iowa Cons. Comm., Quart, Biol. Repts., 15(3):14-27.

Abstract: In 1957, 1958, and 1959, 1,149 walleye and 1,836 sauger were tagged with serially numbered metal jaw tags below Lock and Dam #10 on the Mississippi River. Sex ratios were about 1 male to 2 females for walleye and 1 male to 3 females for sauger. One hundred seventy-six walleye and 289 sauger were recaptured by anglers for known exploitation rates of 15 and 16 percent, respectively. Fifty-three percent of the recaptured walleye and 63 percent of the sauger were taken within 5 miles of the tagging site, and 84 percent of both species were taken less than 50 miles away. Of the recaptured fish, 59 percent of the walleye and 65 percent of the sauger were taken in the home pool, and 68 percent of the walleye and 89 percent of the sauger were taken in the vicinity of lock and dams. Fifty-nine percent of both walleye and sauger recaptures were taken within 6 months after tagging. Forty-eight percent of the walleye recaptures and 53 percent of the sauger were taken during April and May.

Keywords: Iowa, Fish, Survey, Walleye, Sauger

SCHOUMACHER, R. 1963d. A summary of an intensive creel census on Pools 11 and 18 of the Mississippi River. Iowa Cons. Comm., Quart. Biol. Repts., 15(2):51-54.

Abstract: From April through October 1962, one full-time creel census clerk was employed on each of two navigation pools on the Mississippi River bordering Iowa - Pools 11 and 18. This creel census was run on a statistically designed schedule in cooperation with the Upper Mississippi River Conservation Committee, and will be repeated every 5 years to determine trends and changes in the sport fishery.

The clerk interviewed 3,166 anglers in Pool 11, and projected data indicate that 32,408 fishermen fished 168,523 hours and caught 191,059 fish at the rate of 1.13 fish per hour. Crappies, bluegills, sauger, sheepshead, and channel catfish were the most important species numerically in the catch in that order. In Pool 18, 4,606 fishermen were interviewed, and projection of the data indicates that 28,509 fishermen fished 123,991 hours and caught 105,024 fish at the rate of 0.85 fish per hour. Channel catfish, bullheads, crappies, white bass, and sheepshead were the most important species in the creel.

Keywords: Survey, Creel census, Pool 11 and 18, Fish, Iowa

SCHOUMACHER, R. 1964a. Mississippi River catfish investigations in 1963. Part II: small channel catfish and flathead catfish studies. Iowa Cons. Comm., Quart. Biol. Repts., 16(2):42-47.

Abstract: Three thousand one hundred twenty-eight small channel catfish from the Mississippi River were measured and a sample aged during 1963. Ninety percent were from 6 to 12 inches long, and 69 percent belonged to age group II and 19 percent to age group III. Age II fish were about 7.5 inches long in May and 9 inches in August. One hundred ninety-six commercially taken flathead catfish were examined ranging in size from 11 to 38 inches. Forty-eight percent were under 17 inches, 70 percent under 20 inches, and 10 percent 25 inches or longer. Seventy-seven percent from age groups III, IV and V. Average sizes of fish aged II through VII, respectively were: 13.1, 15.4, 17.2, 20.2, 22.3, and 26.4.

Keywords: Survey, Fish, Catfish, Channel catfish, Flathead catfish

SCHOUMACHER, R. 1964b. A brief preliminary report on commercial channel catfish. Iowa Cons. Comm., Quart. Biol. Rept. 16(1): 10-15.

Abstract: Because of a decline in the commercial catch of channel catfish from the Iowa waters of the Mississippi River in recent years, a study was begun of the problem in 1963. A total of 9,415 commercially caught fish were measured at markets and 1,761 of these fish were aged. Nearly half of the fish were under 14 inches long, 71 percent were under 15 inches, and only 2 percent were 19 inches or longer. Generally, age IV fish predominated the catch until July, when age III fish became most important. Fish in Pools 9 and 19 seem to grow faster than in other pools. An intensive harvest of this species is suggested by the data, and studies will be continued.

Keywords: Commercial fishing, Catfish, Channel catfish, Iowa

SCHOUMACHER, R. 1965a. Commercial channel catfish catch studies in the Mississippi River in 1964. Iowa Cons. Comm., Quart. Biol. Repts. 17(2):14-16.

Abstract: A total of 4,861 commercially caught channel catfish were measured as part of a continuing study of this important commercial and sport fish. Spines were taken from 588 for aging. Forty-seven percent of the fish were under 14 inches long, 70 percent were under 15 inches, and only 2 percent were 19 inches or longer. Ninety-six percent of the catch was age III and IV fish. Growth is very good. Studies are continuing to determine the proper management of the species.

Keywords: Commercial fishing, Catfish, Channel catfish, Harvest

SCHOUMACHER, R. 1965b. Movement of walleye and sauger. Trans. Am. Fish. Soc. 94(3):270-271.

Abstract: Immediately below Lock and Dam No. 10 during 1957 (through 1959) tagging studies begun to document the movement and angler utilization of these two species.

Keywords: Lock and Dam 10, Fish, Movement, Sport fishing, Walleye, Sauger, Tagging

SCHOUMACHER, R. 1968. Some observations on flathead catfish in the Mississippi River bordering Iowa. Trans. Am. Fish. Soc. 97(1):65-66.

Abstract: In 1963, studies of the commercial catch of catfish from the Mississippi River bordering Iowa were initiated

by the Biology Section of the Iowa Conservation Commission. These studies were concerned primarily with determing the age and size composition of channel catfish, Ictalurus punctatus (Rafinesque), which dominate the catch, but data were also collected on flathead catfish, Pylodictis olivaris (Rafinesque), as they appeared in the catch.

Keywords: Iowa, Fish, Catfish, Flathead catfish

SCHOUMACHER, R. and G. ACKERMAN. 1964. Comparative age and growth of channel catfish from some eastern Iowa rivers. Iowa Cons. Comm., Quart. Biol. Repts., 16(4):43-50. also published in 1965: Proc. Ia. Acad. Sci. 72:248-253.

Abstract: During 1963 and 1964, catfish populations were sampled in various rivers in eastern Iowa, and 1,391 spines were collected and analyzed for age. Growth rates varied considerably, with fish from the Wapsipinicon River at Anamosa being the slowest growing, followed by fish from the Wapsipinicon River at Independence, the Cedar River at Gilbertville and Cedar Rapids, and the Iowa River at Marshalltown. Faster growth was exhibited by fish from two renovated areas--the Iowa River in the Iowa Falls-Steamboat Rock area and Fontana Mill Lake--, from the lower 8 miles of the Skunk River, and from various pools in the Mississippi River. It is suggested that the removal of a portion of the catfish population in selected areas, perhaps in conjunction with a rough fish removal program, would stimulate catfish growth.

Keywords: Age and growth, Fish, Iowa

SCHOUMACHER, R. and G. ACKERMAN. 1965. Comparative age and growth of channel catfish from some eastern Iowa rivers. Proc. Ia. Acad. Sci. 72:248-253.

Abstract: During 1963 and 1964, catfish populations were sampled in various rivers in eastern Iowa, and 1,391 spines were collected and analyzed for age. Growth rates varied considerably, with fish from the Wapsipinicon River at Anamosa being the slowest growing, followed by fish from the Wapsipinicon River at Independence, the Cedar River at Gilbertville and Cedar Rapids, and the Iowa River in the Iowa Falls-Steamboat Rock area and Fontana Mill Lake--, from the lower 8 miles of the Skunk River, and from various pools in the Mississippi River. It is suggested that the removal of a portion of the catfish population in selected

areas, perhaps in conjunction with a rough fish removal program, would stimulate catfish growth.

Keywords: Age and growth, Channel catfish, Iowa, Catfish

SCHRAMM, H. L., JR. and W. M. LEWIS. 1974. Study of importance of backwater chutes to a riverine fishery. Southern Illinois Univ., Carbondale, Fisheries Research Lab. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 153 p.

Abstract: A comprehensive review was made of the literature to determine the environmental impact of the loss of backwater areas in connection with proposed changes in the channel of the Mississippi River between St. Louis, Missouri, and Cairo, Ill. The review covered two general areas: Literature pertaining to the physical, chemical, and biotic factors of larger rivers, and literature pertaining to the biology of the fishes recorded as present in the section of concern in the Mississippi River. The direct effects of the physio-chemical factors (current, turbidity, substrate, and dissolved oxygen) were examined.

Keywords: Backwater, Chute, Fish, Flow, Missouri, Illinois, Habitat alteration

SCHWARZ, J. and W. W. SAYRE. 1973. Temperature and Ice Conditions in the Mississippi River near Cordova, Illinois since startup of Quad-Cities Nuclear Power Station. IIHR Limited Distribution Report No. 18. Iowa Institute of Hydraulic Research, University of Iowa, Iowa City, Iowa.

Abstract: The first part of this report is concerned with the performance of the side-jet discharge system, and the second part with the studies of the temperature distribution after the diffuser pipe went into operation. In a third part the effect of the heated effluent of the power station on the ice conditions is presented.

This report presents data on water temperatures and ice conditions in the Mississippi River near the Quad-Cities Nuclear Power Station for the period after the power station went in operation.

Keywords: Temperature, Ice, Nuclear power

SCRUGGS, S. 1972. Diatoms as indicators of water quality. J. Tenn. Acad. Sci. 47(4):157-158.

Abstract: Samples taken from 2 stations on the Mississippi River were examined for the diatoms present. The station at the Wolf River Channel indicated the diatoms present before the water was heavily polluted by city wastes. The station at the entrance of McKellar Lake indicates those diatoms found in an area of heavy pollution. The number and kinds of diatoms found have been recorded and will serve as indicators of water quality.

Keywords: Phytoplankton, Periphyton, Water quality

SEFTON, D. R. 1976. The biomass and productivity of aquatic macrophytes in navigation pool no. 8 of the Upper Mississippi River. M.S. Thesis, Univ. of Wis., LaCrosse, WI. 109 p.

Abstract: The biomass of aquatic macrophytes in Navigation Pool 8 of the Upper Mississippi River was determined in order to provide basic data on the productivity, frequency, and distribution of these plants. Two 0.25 m2 quadrats constituted a sample at a given site. All vegetation, including underground parts, was removed from these quadrats. The vegetation in each sample was washed, separated into component species, frozen, dried, and weighed. Oven dry weight of each species per 0.5 m2 was recorded.

During the summer of 1975 samples were taken at sites evenly spaced along transects in each of 41 study areas in Pool 8. Most areas were sampled twice; once in early summer and once in late summer. A diverse, typical hard water flora was found. Ceratophyllum demersum, Sagittaria latifolia, and Vallisneria americana were the most frequently occurring species, while the greatest portion of the total biomass of Pool 8 consisted of Sagittaria latifolia (45.24%), Vallisneria americana (14.33%), and Sagittaria rigida (8.50%). An averge late JulyAugust biomass of 181.70 g/m2 for the littoral zone of Pool 8 was comparable to that for hard water lakes in Wisconsin.

This study has demonstrated that environmental factors interact with each other and with the macrophyte community in determining the amount of biomass.

Two areas, typical of the mid and lower sections of Pool 8, were sampled seven times between May 28 and September 19, 1976. Community composition and productivities were determined for these areas and growth patterns, growth rates, and maximum seasonal

biomass were determined for the major species growing therein. For most species, the seasonal maximum biomass occurred at the time of maximum fruit development, and could be equated with annual net production. In general, submergent communities were less productive than floating leaved communities, whereas emergent communities were the most productive of all.

Keywords: Biomass, Macrophyte, Productivity, Pool 8, Upper Mississippi River, Methods, Age and growth, Distribution

SEKLECKI, R. M. 1967. A chromatographic analysis of the body pigments of Chironomus tentans from Lake Winona and Lake Pepin. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: Using thin-layer chromatography, extracts of various parts and developmental stages of Chironomus tentans were investigated for the presence of UV fluorescing and absorbing pteridines. Pteridines were located in most parts of the insect's body as well as each of the life stages, particularly with the use of n-propanol-water as the solvent. Because the paper was basically exploratory, emphasis was placed on those areas where further research might provide further insight into the pteridine differences between populations of Chironomus tentans, such as solvent type and extraction procedures.

Keywords: Invertebrates, Benthos, Lake Winona, Lake Pepin, Minnesota, Research

SERUM, J. R. 1972. The history of navigation on the Chippewa River. Research paper presented to Graduate Faculty of Winona State College, Winona, MN. 82 p.

Abstract: This study covers the period of navigation on the Chippewa River from the Indian canoes through the steamboats. The study includes a description of the river, its history, the limits of navigation, the major physical problems encountered and the various types of river navigation used on the Chippewa. Special emphasis is given to the period of steamboating. The relationship of navigation on the Chippewa to the economy is included.

Keywords: Navigation, Wisconsin, Chippewa River

SETTE, O. E. 1925. Fishery industries of the United States, 1923. App. IV, Rept. U.S. Comm. Fish. for 1924 (1925) (Bur. Fish. Doc. 976). pp. 141-359.

Abstract: This report constitutes a summary of the activities of the Division of Fishery Industries as well as an annual review on fishery statistics of the United States.

Keywords: Fishing

SETTE, O. E. and R. H. FIELDER. 1929. Fisheries industries of the United States, 1927. App. IX, Rept. U.S. Comm. Fish Doc. 1050. Washington.

Abstract: This report constitutes a summary of the activities of the Division of Fishery Industries as well as an annual review on fishery statistics of the United States for the year 1929.

Keywords: Fishing

SHAW, H. 1965. Bald eagle count on the Mississippi. Audubon Bull. 133:6.

Abstract: We covered the Alton-to-Grafton area, plus the eastern side of Calhoun County from Hardin south to the Brussel's Ferry. Our count for the day was 3 adults and 3 immatures. On Sunday, January 31, after a cold night of -4° F an accumulation of seven inches of snow, we repeated the route of the previous day. We counted 21 adults and 5 immature Bald eagles. About 50% were in flight and the remainder were perched on snags extending from the bluffs in eastern Calhoun County.

Keywords: Survey, Birds, Eagle

SHEA, J. G., ed. 1852. Discovery and exploration of the Mississippi Valley. Redfield, N.Y. 264 p.

Abstract: A history of explorations in the Mississippi Valley with narratives by Marquette, Allouez, Membre, Hennepin and Anastase Douay.

Keywords: History

SHEA, J. G. 1903. Discovery and exploration of the Mississippi Valley, 2nd ed. Albany, Joseph McDonough.

Abstract: History of the discovery of the Mississippi River, narratives of river voyages on the Illinois. Explorations by LaSalle and Marquette are described.

Keywords: History

SHELFORD, V. E. 1954. Some lower Mississippi Valley flood plain biotic communities; their age and elevation. Ecology 35(2):126-142.

Abstract: Forest development on the flood plain of a large river is important in many ways. The constant shifting of islands, bars, and channels provides new ground for beginnings of seres, many of which stop short of the climatic climax so long as flooding continues. This makes the large river flood plain exceptionally useful, and perhaps as important as sand areas in the study of ecological principles.

Keywords: Lower Mississippi River

SHERMAN, W. C., and C. C. TRAHAN. 1961. Results of Tests on Concrete Cylinders and Sand Backfill, Port Allen Lock. Army Engineer Waterways Experiment Station, Vicksburg, MS. 28 p.

Abstract: The tests on concrete cylinders fabricated from materials used in construction of Port Allen Lock indicated an average compressive strength and modulus of elasticity which are in reasonably close agreement with values obtained in an extensive laboratory investigation conducted prior to construction to determine the thermal, elastic, and other properties of the Port Allen Lock concrete. Therefore, the properties of the concrete as determined in the laboratory can be applied with assurance to the concrete placed in the structure. Despite considerable deviations, the average density of the sand backfill, as placed, was equivalent to standard Proctor maximum density. The average density corresponded to a relative density of 74%. The average angle of internal friction of the backfill was estimated.

Keywords: Dam, Lock

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SHERVEY, L. R. 1961. Bottomland occupancy of the Mississippi Valley, Grand Tower to Thebes Gap, Illinois. M.S. Thesis, Southern Illinois University, Carbondale, IL.

Abstract: Though no attempt has been made to review the literature, recent discussions dealing with flood plain occupancy in the United States have focused primarily on urban settlement problems, and agricultural occupancy has been largely ignored, especially studies focusing on the impact of physical characteristics of the land on land use. It is the primary objective of this study to explore the functional relationships of agricultural land use and rural occupancy of the Mississippi River bottomland with respect to certain aspects of the physical environment.

Keywords: Benthos

SHIMEK, B. 1921. Mollusks of the McGregor, Iowa region I. Iowa Conserv., Vol., No. 4, Oct.-Dec. 5 p.

Abstract: A discussion of mollusks which may be found in this area of Iowa with details on their identification, distribution, and life history.

Keywords: Clams, Iowa, Invertebrates, Benthos

SHIRA, A. F. 1917a. Fish cultural activities of the Fairport Biological Station. Trans. Am. Fish. Soc., 47:39-44.

Abstract: Various activities of the Fairport Lab were discussed including mussel and fish propagation. Some of the less publicized activities were discussed especially intensive pond culture studies, artificial hatching in jars, natural food studies and artificial feeding of river fishes.

Keywords: Iowa, Fish, Fish management, Culture

SHIRA, A. F. 1917b. Notes on the rearing, growth, and food of the channel catfish, Ictalurus punctatus. Trans. Am. Fish. Soc., 46:77-78.

Abstract: The channel catfish is one of the most important of the Siluridae as far as food qualities are concerned, its habits have perhaps been known as those of any catfishes. Catfish were raised, growth recorded and food (stomach contents) monitored in different ponds.

Keywords: Age and growth, Fish, Food habits, Catfish, Channel catfish, Culture

SHULL, C. A. 1922. The formation of a new island in the Mississippi River. Ecology 3(3):202-206.

Abstract: A discussion about the formation of Wolf Island; its location, soil, flooding and history.

Keywords: History, Flooding

SHULL, C. A. 1944. Observations of general vegetational changes on a river island in the Mississippi River. Am. Midl. Nat. 32(3):771-776.

Abstract: Wolf Island near Missouri was studied with regard to its vegetation, soil and size. The changes in vegetation over the year; was noted.

Keywords: Vegetation, Succession

SHYNE, J. T. 1968. A survey of total coliform density of Pool 6 of the Mississippi River during spring and summer. B.A. Thesis, St. Mary's College, Winona, MN. 56 p.

Abstract: This research dealt with a survey of the total coliform densities at certain sampling points during the spring and summer of 1967. The samples were taken from five sampling points along eight transects from the city of Winona, Minnesota to a point 4.2 miles down river. Midway between transects one and two on the south shore, the effluent pipe from the primary treatment facility of the Winona sewage plant empties processed sewage into the river. The membrane filter technique was used throughout the study.

Keywords: Survey, Bacteria, Pool 6

SIEH, J. G. 1958. The forecast and advent of mass migration of waterfowl through Iowa in the fall of 1957. Iowa Bird Life, 28:2-4.

Abstract: Mass migration of waterfowl appear to be influenced by high pressure weather systems. Modern meteorological methods and weather forecastings by way of radio and television can help Iowa waterfowl hunters.

Keywords: Iowa, Migration, Waterfowl

SIEH, J. G. and W. ASPELMEIER. 1961. Results of semi-controlled hunting upon the harvest of waterfowl at Lake Odessa, Iowa, 1960. Iowa Acad. Sci., 68:271:280.

Abstract: In 1960 two controlled shooting areas with a total of 25 blind sites were established. The remaining portion of the public hunting area was open to hunting without special restrictions. Checking stations were established at each of the two main access points. A total of 6,014 hunters harvested 6,499 waterfowl in 33,968 hours,averaging one bird for each 5.22 hours of hunting. Waterfowl taken included 14 species of ducks, mergansers, coots, and 3 species of geese. Mallards comprised 72% of the kill, and wood ducks accounted for 12%. Flight dates during the fall were clearly indicated by the peak kills of mallards on October 19, 29, November 3, 9, and 29. The sex ratio of mallards in the kill averaged 1.45 males to 1 female throughout season, but increased during the 5 major flight dates to 1.71:1, indicating preference for drakes. A sample of 666 mallards wings indicated an age ratio of 2.4 young to 1 adult.

Keywords: Iowa, Hunting, Waterfowl, Regulations, Harvest

SIEH, J. G. and W. ASPELMEIER. 1962. Semi-controlled hunting of waterfowl at Lake Odessa, Louisa County, Iowa - 1960 and 1961. Iowa Acad. Sci., 69:265-273.

Abstract: In 1960 and in 1961 two "controlled" shooting areas with a total of 25 "blind" sites were established at Lake Odessa, Wapello, Iowa. The remaining "uncontrolled" portion of the public hunting area was open to hunting without special restrictions. Checking stations were operated at each of the two main access points. A total of 6,014 hunters harvested 6,499 waterfowl in 33,968 hours, averaging one bird for each 5.2 hours of hunting in 1960. In 1961 a total of 3,391 hunters killed 3,391 waterfowl in 17,618 hours, averaging one bird for each 5.2 hours of hunting. Hunter success, expressed as the number of ducks per hunter per day, was 1:1 in 1960 and 1.0 in 1961: however, the aggregate harvest dropped 48 percent in 1961. Season length was reduced 40 percent and there was a 44 percent drop in the number of hunters.

Keywords: Iowa, Hunting, Waterfowl, Regulations, Lake Odessa

SIMONET, R. J. 1978. A study on population dynamics of lotic macroinvertebrate community in the lower reaches of

Pool 3 of the Mississippi River. M.S. Thesis, St. Mary's College, Winona, MN. 130 p.

Abstract: The population dynamics of the lotic macroinvertebrate community of Pool 3 of the Mississippi River were studied through benthic grab sampling and artificial substrate sampling. The drift community was more diverse than the sedentary community. The drift samples were dominated by immature insects of Orders Diptera, Trichoptera, and Ephemeroptera. Population dynamics of the drift community were controlled by the seasonal water temperature with influences by additional factors such as current velocity.

Keywords: Macrophyte, Phytoplankton, Zooplankton, Fish, Invertebrates, Benthos, Main channel, Refuges, Pool 3

SIMONS, D. B. and Y. E. CHEN. 1976. A mathematical model study of Pool 4 in the Upper Mississippi and Lower Chippewa Rivers. U.S. Dept. Int.

Abstract: Purpose was to construct a one-dimensional mathematical model of Pool 4 by formulating the unsteady flow of sediment laden water with the one-dimensional partial differential equations representing the conservation of mass for sediment and the conservation of mass and momentum for sediment-laden water.

Keywords: Models, Pool 4, Upper Mississippi River, Chippewa River, Sediment

SIMONS, D. B., P. F. LAGASSE, Y. H. CHEN, and S. A. SCHUMM. 1975. The river environment, a reference document. U.S. Dept. Int., Fish Wildl. Serv., Twin Cities, MN.

Abstract: The River Environment is organized to develop, first a basic understanding of river morphology and river mechanics, and then, to expand on this basic knowledge and illustrate its application through an examination of the response of the Upper Mississippi River to the activities of man. Two areas of particular environmental concern, river response to channel stabilization and river response to dredging and disposal operations, are examined in detail.

Keywords: Ecology, Hydrology, Hydraulics, Models, Training structure, Flow, Navigation, Commercial boat traffic, Channelization, Sedimentation

SIMONS D. B., S. A. SCHUMM, and M. A. STEVENS. 1974. Geomorphology of the Middle Mississippi River. Colorado State Univ., Fort Collins, Engineering Research Center. 113 p.

Abstract: A comprehensive study of the historical geomorphology of the Middle Mississippi River was made to determine the physical impact of river contraction works on river morphology and behavior, and subsequent effects on the side channels. The studies included physical model studies of the river and side channels, the combined effects of navigation improvement structures and flood protection works on flood stages, and a review of the history of development and modification of the Middle Mississippi River.

Keywords: Hydrology, Side channel, Channel maintenance, Models, Training structure, Flow, Sedimentation, Navigation, Illinois, Missouri, Middle Mississippi River

SIMONS, D. B., S. A. SCHUMM, M. A. STEVENS, Y. H. CHEN and P. F. LAGASSE. 1975. Environmental Inventory and Assessment of Navigation Pools 24, 25, and 26, Upper Mississippi and Lower Illinois Rivers. A Geomorphic Study. Colorado State Univ., Fort Collins. Army Engineer Waterways Experiment Station, Vicksburg, Miss. Army Engineer District, St. Louis, MO. 156 p.

Abstract: This report is a study of the past and present geomorphic features of the reach of the Upper Mississippi River which includes Pools 24, 25, and 26 and the lower reach of the Illinois River. In addition, the report presents the anticipated future geomorphic changes that will result from past, present, and planned future developments of these reaches. The study was based primarily on data collected by the Corps of Engineers, aided with a mathematical model of the river system. On the basis of this study of the past geomorphic changes in Pools 24, 25, and 26 and with the mathematical simulation of future river response, it was concluded that 50 years from now the study area will be essentially as it is today. The present day manner of operation does not have any serious detrimental effects on the geomorphology or hydraulics of the river system in the study area.

Keywords: Upper Mississippi River, Illinois River, Pools 24-26 Survey, Models, Geology, Hydrology, Dam, Channelization, Sedimentation, Habitat alteration

SIMPSON, C. T. 1900. Synopsis of the Naiades or pearly fresh-water

mussels. Proc. U.S. Nat. Mus. 22:501-1044.

Abstract: A discussion of naiades with reference to their physiology, habitat, and taxonomy.

Keywords: Invertebrates, Benthos, Mussels

SIMPSON, E. 1917. Conservation and propagation of fish in the Upper Mississippi River. Trans. Am. Fish. Soc., pp. 36-38.

Abstract: This paper discusses the area of the Mississippi River from Praire du Chen, Wisconsin to St. Paul, Minnesota. The effect of no fishway on the Keokuk Dam is pointed out. This has effected the species diversification in the immediate area.

Keywords: Propagation, Fish, Upper Mississippi River

SINGER, L. and W. D. ARMSTRONG. 1977. Fluoride in treated sewage and in rain and snow. Arch. of Environ. Health, 32(1): 21-23.

Abstract: The liquid effluent of a sewage treatment plant contained 1.21 ppm ionic and total fluoride, which was higher than 1.0 ppm fluoride in the fluoridated public water supply. The discharge of the effluent into a river did not greatly raise the fluoride content of the river water because of dilution and other factors. The semisolid waste of sewage treatment also contained fluoride, but very little was volatilized on burning. Rain and snow were found to contain detectable quantities of fluoride, and the fluoride content of snow increased markedly during exposure to an urban environment.

Keywords: Pollution, Chemistry, Minnesota

SKRYPEK, J. L. 1965a. Three years of winter catfish angling on Lake Pepin, 1962-1965. Minn. Dept. Cons., Invest. Rept. No. 286. 7 p.

Abstract: Creel census data from the Mississippi River indicates that each winter about 60,000 man-hours are spent fishing through the ice on the portion of the river extending from Lock and Dam 3 near Red Wing, Minnesota to Lock and Dam 4 at Alma, Wisconsin. Lake Pepin sup-

ports the bulk of this fishing pressure. In the past on Lake Pepin the most abundant fish in the ice fisherman's creel have been the black crappie, sauger, yellow perch and walleye. During the winter of 1962-63 ice anglers developed the techniques necessary for the taking of channel catfish through the ice. The channel catfish became the third most important fish creeled in the winter of 1962-63, constituting 13.6 percent of the total catch.

Keywords: Fish, Lake Pepin, Minnesota, Sport fishing, Ice, Catfish

SKRYPEK, J. L. 1965b. Gone fishin' -on Ol' Man River. The Conservation Volunteer, Minn. Dept. Cons. p. 52-54.

Abstract: The personal fishing records of a resident of one of the towns on the lower river is used to show how important the river may be in the life of an angler.

Keywords: Sport fishing

SKRYPEK, J. L. 1969. Difference in the composition of the fish population in Pool 2 and other areas of the Mississippi River as related to the waste from the Twin City Metropolitan Area-1964. Minn. Dept. Nat. Res., Investigational Rept. No. 307.

Abstract: In order to obtain current information on the status of the fish population in Pool 2 of the Mississippi River, exploratory fishing was conducted during August and the first part of September 1964. This survey was initiated and carried out because of increased interest in the pollution problems of the Upper Mississippi River and because scheduled improvements in sewage treatment by the Minneapolis-St. Paul Sanitary District make it desirable to know the condition of the fish populationin this area of the river.

Keywords: Pool 2, Fish, Popululation, Pollution, Biological alterations

SMART, M. M. 1977. Nitrogen and phosphorus cycling by Nymphaea tuberosa and Ceratophyllum demersum in Lake Onalaska, navigational pool no. 7 of the Upper Mississippi River, M.S. Thesis. Univ. of Wis., La Crosse, WI.

Abstract: Nitrogen and phosphorus cycling by Nymphaea tuberosa and Ceratophyllum demersum was studied in Lake Onalaska,

Navigation Pool 7 of the Upper Mississippi River, for a one-year period. The influence these macrophytes exerted on the sediments, waters, and on the exchange between sediments and water was determined.

Three sampling stations were studied; a monotypic stand of Nymphaea tuberosa, a monotypic stand of Ceratophyllum demersum, and a control area representative of the majority of Lake Onalaska. Sampling occurred once every two weeks. At each sampling time representative samples of sediments, water, and plant material were collected and analyzed for nutrient content. Biomass at each sampling site was also determined. Multiple correlation among sediment, water, and plant nutrient concentrations were calculated, as were the absorption and loss of nutrients from the sediments, water, and plant material.

Keywords: Chemistry, Pool 7, Upper Mississippi River, Macrophyte, Biomass, Lake Onalaska

SMITH, C. and S. G. DE BOER. 1957. Open doors along the Mississippi. Wis. Cons. Bull. 22(11).

Abstract: Access to the river is becoming a reality as a result of cooperation among the Conservation Department, railroads, highway departments, county boards, sportsmen's groups and interested individuals.

Keywords: Upper Mississippi River

SMITH, H. M. 1898. Statistics of the fisheries of the interior waters of the United States. U. S. Comm. Fish and Fish. Comm. Rpt. for 1898. (App. 11). pp. 489-574.

Abstract: A detailed summary of the fishery statistics of the Mississippi River states giving comparisons of fishing methods, the amount of capital invested in fisheries, and dollar values of various fish species.

Keywords: Fish management, Statistics

SMITH, H. M. 1899. The mussel fishery and pearl-button industry of the Mississippi River. Bull. U.S. Fish Comm. 18: 289-314.

Abstract: Mussels and their utilization for buttons and food were discussed. Methods and apparatus for collection

were compared. Socio-economic factors of collecting and manufacturing buttons were discussed at length also.

Keywords: Mussels, Production, Benthos, Industry

SMITH, H. M. 1920. When father of waters goes on a rampage. Natl. Geog. Soc. 37(4):369-386.

Abstract: One of the most important of the varied functions of the United States Bureau of Fisheries is an effort to mitigate the damage done annually to prospective food supply of the country by a cataclysm involving untold millions of fish in the Mississippi River and its tributaries.

Keywords: Flooding, Fish

SMITH, L. L., JR. 1946. Cooperative fishery survey of the Upper Mississippi River. Trans. Am. Fish. Soc., 76:279-282.

Abstract: Representatives from the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin and from the United States Fish and Wildlife Service, meeting in December 1943, formed the Upper Mississippi River Conservation Committee for the purpose of carrying on scientific investigations of the fishery and wildlife resources of the Mississippi River from Caruthersville, Missouri, to Hastings, Minnesota. Although originally planned as a post-war project, field operations were started in the spring of 1944. Field work was divided between two units, one operating from Dubuque, Iowa, northward and one operating from Dubuque southward. Status of the fish population was determined by test-netting, and condition of the commercial and sport fisheries was checked by commercial fishing reports, contacts with commercial fishermen, and creel census. Results of preliminary studies indicate that several types of regulations will be needed in different areas because of different ecological and economic conditions.

Keywords: Survey, Upper Mississippi River, Fish

SMITH, L. L., JR. and W. M. KOENST. 1974. Temperature Effects on Eggs and Fry of Percoid Fishes. USEPA National Water Quality Laboratory. 99 p.

Abstract: Temperature effects on the early life history stages of the walleye (Stizostedion virtreum vitreum (Mitchill)) and sauger (Stizostedion canadense (Smith)) were

examined. Walleye eggs and fry were exposed to six temperatures (6-21 C) for effects on fertilization, incubation, and fry survival. Mature sauger were held and eggs were fertilized at four temperatures (9-18 C). Both species were incubated at 6-21 C. Sauger fry survival was also tested at 6-21 C. Optimum fertilization temperatures were 6-12 C for walleye and 9-15 C for sauger. Optimum incubation temperatures were 12-15 C for both walleye and sauger. A sharp drop or rise in temperature had no great effect on walleye fry and juvenile survival except when the upper lethal or lower lethal temperature was approached. Optimum temperature for juvenile walleye and sauger growth was 22 C. Upper lethal temperatures at 2 C intervals between 8-26 C. The upper lethal temperature of walleye juveniles was 27.0-31.6 C, depending on acclimation. The upper lethal temperature of sauger acclimated to 10-26 C was 37.3-45.4 C. There was little temperature difference (1-2 C) between 100% survival and no survival.

Keywords: Sauger, Walleye, Age and growth, Pollution

SMITH, P. W. 1965. A preliminary annotated list of the lampreys and fishes of Illinois. Ill. Nat. Hist. Surv. Biol. Notes No. 54. 12 pp.

Abstract: The present list contains a substantial amount of new distributional data, including several new records for the state. Species are grouped under family names and arranged in alphabetical order by genus and species. for each species a concise statement regarding its current distribution in the state is given.

Keywords: Lamprey, Fish, Illinois, Species list

SMITH, P. W. and A. C. LOPINOT and W. L. PFLIEGER. 1971. A Distributional Atlas of Upper Mississippi River Fishes. Bio. Notes No. 73. 20 p. Ill. Nat. His. Surv. Urbana, IL.

Abstract: Growing concern over pollution and habitat alteration in the Mississippi River prompted this paper which gives the present distribution of fishes in that river.

Keywords: Upper Mississippi River, Illinois, Minnesota, Fish, Pollution, Distribution, Survey

SNEED, K. 1950. A method for calculating the growth of channel catfish, Ictalurus lacustris punctatus. Trans. Am.

Fish. Soc., 80:174-183.

Abstract: Evidence from previous studies of the rings on bone structures of fish indicates that in a number of species they are true year marks. Among the species of fish to which this method has been applied is the channel catfish. In order to determine the possibility of computing growth during successive years of life by means of bone markings, the left pectoral spines were collected from 204 channel catfish from Grand Lake, Oklahoma. These spines were cut in cross-section near the base, and the radii of the several growth fields and of the entire spine were measured with a micrometer mounted on a binocular microscope. These measurements revealed a high coefficient of correlation (r = 0.969) between body length and spine radius.

The straight line fitted to the measurements of fish length and spine radius for 187 fish had an intercept of -3.24 millimeters of fish length. Since this intercept is zero for all practical purposes, growth calculations were made by direct proportion. Both the method of aging and calculating growth of channel catfish appear to be satisfactorily accurate, since (1) the number of spine rings increases as the average length of the fish increases; (2) the calculated length of age-group II at the end of the second year of life slightly exceeds the measured length of age-group III slightly exceeds the measured length of age-group II when captured in August; and (3) the markings on the pectoral spines of 50 channel catfish of know age corresponded to the markings as read on the spines collected from Grand Lake.

Keywords: Age and growth, Fish, Catfish, Channel catfish, Methods

SOLOMON, R. C., J. H. JOHNSON, C. R. BINGHAM and B. K. COLBERT. 1974. Physical, Biological, and Chemical Inventory and Analysis of Selected Dredged and Disposal Sites, Middle Mississippi River. Army Engineer Waterways Experiment Station, Vicksburg, Miss. Army Engineer District, St. Louis, MO. 207 p.

Abstract: Sediments deposited in the channel by fluvial processes and material derived from the products of bank erosion pose a continuous dredging and disposal problem in the Mississippi River navigation system. Only a limited amount of data are available on the physical, chemical, and biological characteristics of the Middle Mississippi River as related to dredging and disposal opeations.

The study was undertaken: to provide background information on the physical, chemical, and biological characteristics of selected dredged and disposal sites; (2) to establish uniform procedures for sampling dredged material and biota in a riverine system; and (3) to describe the environmental impacts of dredging and disposal activities. Fifteen sites with prior histories of maintenance dredging and adjacent disposal operations and three river border areas with no history of dredging-disposal operations were sampled in September 1973.

Keywords: Ecology, Dredging, Plankton

SOLOMON, R. C., D. R. PARSONS, D. A. WRIGHT, B. K. COLBERT and C. FERRIS. 1975. Environmental invenotry assessment of navigation pools 24, 25, and 26, Upper Mississippi and Lower Illinois Rivers. Summary Report. Army Engineer Waterways Experiment Station, Vicksburg, MS. 100 p.

Abstract: The River and Harbor Act of 3 July 1930 authorized the construction and maintenance of a 9-ft-deep by 300-ft-wide channel for commercial navigation of the Upper Mississippi and Lower Illinois Rivers. Construction of locks and dams supplemented by dredging and bank stabilization was required to maintain the 9-ft depth, particularly during periods of low flow. An investigation was performed by Colorado State University to evaluate the river reaches before and after manmade changes and overall changes in geomorphology. Additionally, trends of future geomorphic changes that could result from existing and potential future developments were addressed with the aid of a mathematical simulation model. Vegetation and vegetative successional patterns of the floodplain were characterized by the Missouri Botanical Gardens. Vegetation maps were produced delineating vegetational communities adjacent to the rivers and on islands. An inventory of the animals and their habitats was conducted by Southern Illinois University.

Keywords: Upper Mississippi River, Illinois River, Commercial boat traffic, Geology, Hydrology, Models, Wildlife, Vegetation, Habitat alteration, Habitat

SORENSEN, A. H. 1974. Dredging-part of cure for ecological ailments. World Dredging and Marine Construction, Dec. 74. 10(14):31.

Abstract: The dredging industry has been instrumental in building many important projects in the world. Including the Panama Canal, the Suez Canal, the Intercoastal Canal System, Miami Beach, and most of Holland. The dredging and construction industries have also restored wildlife and wildlife refuges. The dredging industry remains an ecological "villain" in the minds of most people. Partly because these and other environmentally profitable projects of the industry have never been publicized.

Keywords: Dredging, Wildlife, Habitat management

SOUTHALL, J. B. 1925. Mussel survey of Lake Pepin in 1924. Economic Circular, No. 57. U. S. Bur. Fish., pp. 1-3

Abstract: Investigations showed that restoring of streams would not alone restore the streams to their past populations. Lake Pepin was closed therefore to shelling to increase the numbers of mussels.

Keywords: Survey, Mussels, Lake Pepin

SPARKS, R. E. 1975. Environmental Inventory and Assessment of Navigation Pools 24, 25, and 26, Upper Mississippi and Lower Illinois Rivers. An Electrofishing Survey of the Illinois River. Illinois Natural History Survey, Havana River Research Lab. Army Engineer Waterways Experiment Station, Vicksburg, MS. 124 p.

Abstract: The fish populations of the Illinois River were sampled in the autumn of 1974 by means of a 220-volt AC electroshocker, as part of an environmental inventory and assessment of effects of maintenance and operation of the nine-ft navigation channel in Pools 24, 25, 26 on the Upper Mississippi River and lower 80 miles of the Illinois River. Comparative data were available from similar electrofishing surveys conducted from 1959 through 1973. Commercial fishing statistics and results of earlier fish surveys were available as far back as the 1870's. The Illinois River begins at the confluence of the Kankakee and Des Plaines Rivers. The effect of municipal and industrial discharges from the Chicago-Joliet area was evident in electrofishing catches from the Des Plaines River.

Keywords: Illinois River, Fish, Survey, Navigation, Pollution, Turbidity, Temperature, Illinois, Nine-foot channel, Habitat alteration, Biological alterations

SPINNER, J. P. 1968. Environmental effect on the spawning run of northern pike and walleye in the Upper Mississippi River. Proc. of North Central Warm-Water Fish Culture Workshop, Iowa Coop. Fish Unit. p. 9-12.

Abstract: Walleye spawn in the Upper Mississippi River when temperatures are 7.8-8.9 C. For management purposes it was suggested that peak of walleye egg taking is when the temperature reaches 8.9-11.1 C. Tests were made on walleye eggs taken from the Mississippi River.

Keywords: Spawning, Northern Pike, Pike, Walleye

SPINNER, J. P. 1974. Northern Pike Culture, 1974. Pool 9 of the Mississippi River at Lansing. Iowa Cons. Comm. Proj. No. 74-II-C-84. pp. 154-155.

Abstract: Iowa's source of brook northern pike was Pool 9 of the Mississippi River. Abundant brood northerns are netted in the backwaters and sloughs in late March and early April for the propagation of fry and fingerlings to be stocked as requested by management biologists. The fry produced at the Lansing Hatchery are either stocked into receiving waters as swim-up fry or are transported to ponds and reared to fingerling size.

Keywords: Iowa, Pool 9, Fish, Stocking, Fish management, Pike, Northern pike, Propagation

SPINNER, J. and R. E. CLEARY. 1959. Mississippi River trapnet catches and Lansing, Iowa, 1955-1959. Iowa Cons. Comm. Mimeo., unpublished. 3 pp.

Abstract: As a part of routine hatchery procedure, the Fisheries Management Section annually fishes for 4 weeks from 20-30 trap nets in the slough areas of the Mississippi River north of Lansing, Iowa. Crappie and Bluegill increased steadily and markedly between 1955 and 1959. Yellow Perch and carp also increased. The first week of any netting period accounts for 36% of the 4 weeks catch, the first two weeks, 67%. The authors feel that this is due to the wariness gained by the fish to a fixed trap.

Keywords: Iowa, Fishing, Catch

SPINNER, J. and R. E. CLEARY. 1960. Mississippi River trap net catches at Lansing, Iowa, 1955-1959. Iowa Cons. Comm.,

Quart. Biol. Repts., 11(2):9-12.

Abstract: The catch in a group of thirty trap nets set to collect brood fish for inland hatcheries and stocking inland waters indicates a persistent increase in crappies, bluegills and yellow perch populations, despite relaxed sport fishing regulations.

Further analysis of the annual catch indicated a wariness or avoidance of nets set in a general locality for long periods of time.

This phenomenon is important to the fish manager in that nets over two weeks in one location lost 50% of their effectiveness. It also is important to the biologist attempting to fix population estimates on lont-term mark and recapture project. The wariness of a fish taking a fixed net the second time after an initial capture would tend to swell the estimated size of the population.

Keywords: Iowa, Fishing

SPIREK, J. 1971. Limitation of Acanthocephalan infestation of Roccus chrops Pool No. 6 in the Mississippi River. M.S Thesis, St. Mary's College, Winona, MN.

Abstract: This study was designed to analyze the limitation of Acanthocephalan infestation, especially Leptorhyncoides thecatus, in the White Bass, Roccus chrysops. Two hundred White Bass, primarily of ages one and two years, were collected by hook and line fishing from Pool 6 of the Upper Mississippi River. The fish were dissected and examined under dissection microscopes. Data derived were analyzed by means of an IBM 1130 computer.

The results of this study indicated an 11.4% infestation of the one year old Roccus chrysops by Leptorhyncoides thecatus. Infestation in the two year old White Bass was recorded 0%.

Keywords: Pool 6, Parasites, White bass

SPIREK, L. J. 1970. The rate and factors influencing the infestation of Hyalella azteca by Acanthocephalan Leptorhyncoides thecatus and Polymorphus minutus in Pool No. 5A in the Mississippi River. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: This study was designed to determine the extent of infestation of Hyalella azteca by the Acanthocephala, Leptorhyncoides thecatus and Polymorphus minutus, in Pool 5A of the Mississippi River.

Data were collected by means of dip nets at thirteen preselected sites throughout the length of this pool. The parasites were identified by means of a microscope and a key of the larval stages.

Keywords: Pool 5A, Parasites, Invertebrates

STALL, J. B. 1972. Effects of sediment on water quality. J. of Env. Quality, 1(4):353-361.

Abstract: Flowing water in a stream carries sediment which is considered a pollutant because it interferes with many uses of water. Other pollutants in the water may be attached to or greatly affected by the sediment. The ultimate source of most sediment is soil loss from sheet erosion which can be computed by the universal soil loss equation. It may be as high as 100 metric tons/ha per year on a steep, loose, cropped soil, or on any soil left bare during construction activity. Nearly level land in Illinois may lose 10 tons/ha per year regularly.

Sediment yield, or that delivered to a downstream point, can be estimated from the many measurements available. Yield are 15 tons/ha per year in Mississippi, the highest in the United States; yields are 10 in western Illinois and western Iowa, and less than 2 for the forest-covered east and arid west. Sediment problems are usually proportionate to sediment yields. In the Upper Mississippi River Basin 27% of the land has sediment yield double the level described as being tolerable. In this basin total sediment damage of $25 million/year is about comparable in amount to the upstream damage done by all floods.

Rivers carry a load of suspended sediment as a crucial part of their total energy balance. This natural sediment load is reflected in the median turbidity of 33 Jackson turbidity units found to be representative of all river waters in Illinois. If the suspended sediment load of a river is reduced, the stream will erode its bed or banks to pick up sediment to re-establish its energy balance.

Keywords: Water quality, Sediment, Turbidity, Geology, Hydrology

STANSBERY, D. H. 1967. A provisional classification of the Pleurobema cordatum (Rafinesque, 1820) complex in the Mississippi River drainage basin of North America (Mollusca: Pelecypoda: Unionacea). Pap. pres. at the 15th Ann. Mtg. Midw. Benthological Soc., Carbondale, IL. Mimeo. 2 pp.

Abstract: Originally described from single specimens or very small lots, the forms comprising the Pleurobema cordatum comples were treated as separate species for over half a century. Systematic collecting of material of this complex by Ortmann revealed that the variation of each of these forms overlapped (in most if not all of the characters then considered diagnostic) at least one and sometimes two of the other forms. The soft parts of all were found to be essentially indentical and Ortmann concluded that the complex was single species comprising four sub-species or varieties. The fact that the most compressed form was typically found in the headwaters while the more swollen forms with higher umbones were normally taken in the big rivers led to the general inference that the complex was due primarily to environmental rather than genetic variation. Recent collecting and a restudy of the literature and museum specimens has established several puzzling facts. The extreme "big river" form is the one found furthest upstream in the Clinch River system where it is accompanied by the "small stream" form without a trace of intermediates. At several localities, two forms of the complex exist side by side maintaining their identity without perceptible integradation and in the Green River at Munfordville, Kentucky, four forms of this complex are found in numbers of the same riffle without intermediate specimens. The indication is that this complex is composed either of four very closely related, very similar yet distinct, species or is a single species exhibiting a gene-linkage or other genetic (?) phenomenon as yet unrecognized as occuring in nature.

Keywords: Clams, Mollusks, Taxonomy

STANSBERY, D. H. 1970. Eastern freshwater mollusks (I) The Mississippi and St. Lawrence River systems. Malacologia 10 (1):9-22.

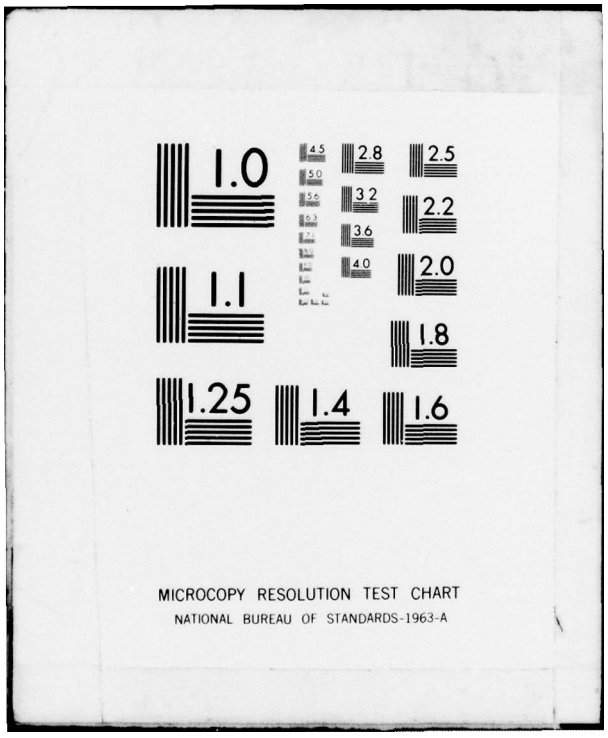
Abstract: This paper discusses post-Columbian history, rare and endangered species and different classes with pictures of the species.

Keywords: Endangered species, Mollusks

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STEFAN, H. and C. V. NHUYEN. 1976. River and Cooling Water Temperature Fluctuations. J. Hydraulics Division ASCE. 102(11):1613.

Abstract: Cooling water discharged from a power plant changes the fluctuating water temperature characteristics of a receiving river. Daily and hourly water temperature data from two power plant sites were used to compute the magnitude of such differences. Extreme value analysis, autocovariance and spectral analysis, an nonlinear curve fitting methods were applied. Results indicate that time series analysis of water temperatures measured downstream from a cooling water outfall may provide equally, or even more realistic and useful information on the size of cooling water plumes than quasi-instantaneous surveys of spatial water temperature distributions may.

Keywords: Thermal effluent, Temperature, Models, Hydrology

STEIN, C. B. 1962. An extension of the known range of the Asiatic Clam, Corbicula fluminea (Muller) in the Ohio and Mississippi Rivers. Ohio J. Sci. 62(6):326-327.

Abstract: This report documents presence of Corbicula fluminea north into the upper Ohio River from Louisiana.

Keywords: Distribution, Clams, Benthos, Ohio River

STEIN, M. 1969. Conference to consider the establishment of water quality standards for the Mississippi River Basin Interstate Waters. State of Iowa. Federal Water Pollution Control Admin., U.S. Dept. of Interior, Washington, D.C. 646 pp.

Abstract: This session considers the Mississippi River and the interstate waters of Iowa which drain into it. Topics dealt with concern: waste discharges, disinfection of controllable waste discharges, and temperature criteria for interstate waters.

Keywords: Water quality, Iowa

STERNBERG, R. B. 1969. Angler creel census of Pools 4 and 5 of the Mississippi River, Goodhue and Wabasha Counties, Minnesota, in 1967-1968. Minn. Dept. Nat. Res., Invest. Rept. No. 306.

Abstract: A creel census conducted on Pools 4 & 5, in 1967-68

showed that these pools were fished mostly by residents of the counties bordering this river area. The largest percentage of anglers fished from small boats. The most popular method was with natural bait. The average catch rate was 0.71 and 0.72 fish per manhour in Pools 4 & 5, respectively. Crappie, bluegill, sauger and walleye were the most common fish caught.

Keywords: Creel census, Pools 4 and 5, Sport fishing, Fish

STERNBERG, R. B. 1971a. Upper Mississippi River Habitat Classification Survey: Hastings, Minnesota to Alton, Illinois. Published by: UMRCC Fish Technical Section. Finished by U.S. Army Corps of Engineers and Minn. Dept. Nat. Res. Upper Mississippi River Conservation Committee, Fish Tech. Sec. Rept.

Abstract: Habitat types in the Upper Mississippi River are more varied than in the Lower Mississippi River and provide for a higher quality of fishery. This report describes the types of habitats and defines them. They are: backwater, channel, chute, lake, pond, pool, slough, main channel, main channel borders, tail waters, and side channels.

Keywords: Upper Mississippi River, History, Habitat, Pool 3-26, Survey, Geology

STERNBERG, R. B. 1971b. Mississippi River Spring creel census in the tailwaters of Pools 4 and 5, 1968-1970. Minn. Dept. of Nat. Res., Invest. Rept. No. 311.

Abstract: In the spring of 1968, a creel census was conducted by the Minnesota Conservation Department in the tailwaters of Lock and Dam No. 3 and Lock and Dam No. 4 to determine fishing pressure, catch rates, and total harvest.

Since there are many factors which affect the catch of walleyes and saugers in the spring tailwater fishery, short term creel census statistics are not a reliable index of population structure. However, over a long period of time, trends in population characteristics may be reflected in creel census statistics.

This report covers each spring creel census separately and compares data from the three years.

Keywords: Creel census, Tailwater, Pools 4 and 5, Pressure, Harvest

STERNBERG, R. B. 1974. Assessment of Continuous Walleye-Sauger Fishing at Lock & Dam No. 3 and 4 of the Mississippi River, 1968-74. Minn. Dept. Nat. Res., Rept. #332.

Abstract: Fishing has increased at Lock & Dam #3 since 1968, whereas Lock and Dam #4 was stable until a sharp increase in 1973 & 1974. Walleye and sauger catches at Lock & Dam #3 have been variable since 1968; and consistent at Lock and Dam #4 until 1973 & 74 when they increased. Still fishing with natural bait was the most popular technique at both dams, however artificial lures were more effective at both dams.

Keywords: Lock and Dam 3 and 4, Survey, Fishing, Walleye, Sauger, Methods

STOLL, J. K. and R. D. BROWN. 1975. Inventory of Physical and Cultural Elements, Middle Mississippi River Floodplain (River Reach - St. Louis, Missouri, to Cairo, Illinois). Army Engineer Waterways Experiment Station. Vicksburg, MS. 143 p.

Abstract: A general environmental inventory of physical and cultural elements in the Middle Mississippi River flood plain (St. Louis, MO, to Cairo, IL) is provided as a reference source for preparation of environmental impact statemenst. Physical elements discussed include geology, soils, and climate. Cultural elements are population, economic conditions, waterborne commerce, archeology, history, outdoor recreation, and land use. Geological data, including maps prepared at a scale of 1:250,000, are presented for regional bedrock geology, structural geology (including seismic activity), economic geology, and physiography. Other geology-related items discussed are groundwater geology, historical geology, and rare and unusual geological features. Available maps and narrative descriptions for soils in the Missouri and Illinois counties bordering the river channel are presented for soil classifications relevant to agricultural use.

Monthly averages of temperatures and precipitation for St. Louis and Cairo, climatic effects on agriculture, and severe weather are discussed.

Keywords: Middle Mississippi River, Flooding, Missouri, Illinois, Recreation, Geology, Hydrology

STOUT, G. E. 1974. Proceedings of the Workshop on Research Needs Related to Water for Energy Held in Indianapolis, Indiana on October 20-22 1974. Univ. of Illinois, Urbana.

Water Resources Center. Office of Water Research and Technology, Washington, D.C. 299 p.

Abstract: Development of large scale energy conversion facilities and their impact on water resources in the Ohio River, Great Lakes and Upper Mississippi River basins was studied at and interdisciplinary workshop. Within limits determined by available water resources and minimization of environmental impact, participants identified areas in which research will be needed if energy conversion facilities are developed. Coal gasification and liquefaction received special emphasis. Included are 2 papers on coal conversion processed and related water requirements, 9 papers with commentaries related to main topic and reports of discussion groups which identify research needs and rank them in importance.

Keywords: Upper Mississippi River, Pollution, Ecology, Limnology, Hydrology

STRENSKI, M. 1977. A study of Phycoperiphyton community in the Black River, La Crosse County, Wisconsin. Thesis, Univ. of Wisconsin - La Crosse.

Abstract: Phycoperiphyton taxonomic composition, numbers, biomass, and pigments were analyzed from two stations at each of four sites and water samples were also collected at each of the four sites during the open water season, April through November 1976. Floating samplers fitted with glass slides served as the phycoperiphyton substrate. Station selection was based on current velocity and direct sunlight. The following measurements were made at each site: temperature, dissolved oxygen, pH, alkalinity, calcium and total hardness, orthophosphorus, nitrate, and nitrite. River depth and current velocity were measured at each station.

Keywords: Wisconsin, Periphyton

STRINGHAM, E. 1917. Fish laws of Mississippi River states. App. IV, Rept. U.S. Comm. Fish for 1916. Dept. of Commerce, Bureau of Fisheries, (B. F. Doc. 840): 5-16.

Abstract: State laws which concern methods of fishing, gear, season, and licenses required.

Keywords: Fishing, Equipment

STRINGHAM, E. 1919. Fish laws of states bordering on the Missis-

sippi and Ohio rivers. Rept. U.S. Comm. Fish for 1918, App. II. pp. 5-21.

Abstract: A digest of statutes relating to the protection of fishes and other cold-blooded aquatic animals. Fishing gear, season, and bag limit restrictions are given by state.

Keywords: Fishing

STRODTHOFF, K. M. 1978. Nitrogen and phosphorus exchanges between water, sediment and macrophytes in Lake Onalaska of Pool 7, Upper Mississippi River, 1975 to 1976. M.S. Thesis, Univ. of Wis., La Crosse, WI. 113 p.

Abstract: A study was conducted to determine the annual cycling of nitrogen and phosphorus at three sites of Lake Onalaska of the Mississippi River - Pool 7 from 1975 to 1976. Water, sediments and individual species of aquatic macrophytes were collected and analyzed for concentrations of nitrogen and phosphorus to establish the pattern of cycling.

Data were collected for dissolved oxygen, pH, alkalinity and depth. Water and sediments were analyzed for nitrite-nitrogen, nitrate-nitrogen, total kjeldahl nitrogen and orthophosphate-phosphorus. Macrophytes were analyzed for total phosphorus and total kjeldahl nitrogen.

Keywords: Sediment, Chemistry, Macrophyte, Pool 7, Upper Mississippi River, Water quality

STRODTMAN, L. L. 1940. Fish rescue work on the Mississippi River Wis. Cons. Bull., 5(3):15-19.

Abstract: With the closing of the boating season on the Mississippi about November 15, the waters of the river in the pool between Dam 11 at Dubuque, Iowa, and Dam 10 a few miles above Cassville began to fall as the retaining gates were lowered at Dubuque. The purpose of this was said to be that of avoiding serious ice jams at the dams, and also to facilitate the cutting of certain timber on flooded areas.

But the receding waters played havoc with the millions of game fish, both large and small, that were trapped in the shallow sloughs that were ordinarily connected with the river at normal water stage. These shallow waters at once began to dry up and the trapped fish began to die. The condition in places where there was

several feet of water, and where the fish could have lived for a while, was ade worse by the approach of severe cold. Ice soon formed to a depth of ten inches, shutting off the supply of oxygen.

Keywords: Fish management, Rescue

SULLIVAN, J. K. 1971. The Development and Current Status of the Upper Mississippi River Commercial Fishery. Ph.D. Thesis, Univ. of Mich., Ann Arbor, MI. 196 p.

Abstract: This study is concerned with an investigation of factors affecting the present status and historical development of the Upper Mississippi River commercial fishery. This was accomplished by a review of the fishes available to the fishery, estimation of their relative abundance in the total ichthyomass of the River, and an analysis of changes in abundance over time; a review of the literature relating to descriptive and statistical data on historical development of the fishery; an investigation of the origins of and changes in consumer preferences for River fishes and the effects of such changes on markets for these species; a survey of [illegible] determine various social and economic characteristics of fishermen currently in the industry including income, age, work history, employment alternatives, and the dynamic aspects of entry into and exit from the industry; and a discussion of stated and implied objectives of River fishery management agencies and how these relate to the foregoing.

Keywords: Upper Mississippi River, Fish, Ecology, Survey, Commercial fishing

SUMNER, J. D. 1931. Recent development in Mississippi River transport with particular reference to the federal barge line. Ph.D. Thesis, Northwestern University, Evanston, IL.

Abstract: The focus of the analysis presented in this study has been the recent changes that have occurred in freight traffic on the Mississippi River proper, with special attention to the traffic of the federal barge line.

Keywords: Barges, Navigation, History, Commercial boat traffic

SURBER, E. W. 1929a. The bottom fauna and plankton as food of the smaller slough fishes in the Upper Mississippi Wildlife and Fish Refuge. M.S. Thesis, Univ. of Minn. 96 p.

Abstract: In May 1928, the writer began preparations for a general study of the sloughs, natural ponds, and lakes in the bottomlands of the Upper Mississippi wild Life and Fish Refuge. The aims of the survey were to discover natural ponds of sloughs which could be converted into fish ponds, and to obtain some biological information about the sloughs which would be of values, in some measure, inproviding the proper scientific background upon which to proceed with an expansion of th efish cultural progrm of the U.S. Biological Station at Fairport, Iowa, into this region. This paper deals, primarily, with the latter phase of the work.

Keywords: Benthos, Plankton, Fish, Food habits, Upper Mississippi Wildlife and Fish Refuge

SURBER, E. W. 1929b. The utilization of sloughs in the Upper Mississippi Wildlife and Fish refuge and fish ponds. Trans. Am. Fish. Soc., 59:106-113.

Abstract: The purpose of the investigation was to discover sloughs which could be used for the culture of bluegill, sunfish, bass or other desirable species. At the same time collections of fish, plankton and bottom fauna were made in several localities. The results of these studies afforded an idea of the life which occurs in the sloughs. This year actual experiments in the utilization of sloughs were begun. Quantitative collections of the bottom fauna and plankton have been made at intervals of two weeks throughout the summer in order to obtain definite ideas of the natural food produced in the bodies of water which are to be utilized. Likewise oxygen, carbon-dioxide samples and temperatures were obtained to aid in affording the proper scientific background.

Keywords: Slough, Upper Mississippi Wildlife and Fish Refuge, Fish

SURBER, E. W. 1930. A method of quantitative bottom fauna and facultative plankton study employed in a year's study of slough biology. Trans. Am. fish. Soc. 60:187-198

Abstract: It is the purpose of this paper to show how the usual method of measuring fish food in experimental ponds by plankton sampling or qualitative collections may be supplemented by the use and manipulation of quantitative bottom sampling apparatus.

Keywords: Benthos, Plankton, Research, Slough, Methods

SURBER, E. W. 1954. Bottom fauna survey on three Mississippi River sloughs in Pool 6, May 26-27, 1953. Proc. Ann. Meeting, Upper Mississippi River Conservation Committee, 10:36-39.

Abstract: During the period June 29, 1929 to June 30, 1930, bottom samples were collected in five sloughs in the Upper Mississippi River at two-week intervals throughout the year. During most of the period these sloughs were isolated from the main channel of the Mississippi River; however, during high-water periods, usually in May or June, they became connected with the river for brief periods.

Keywords: Benthos, Slough, Pool 6, Survey

SUTHERLAND, J. and M. SHURGOT. 1975. Dredging in the Father of Waters. Not Man Apart. 5(1):1.

Abstract: The Upper Mississippi River Wildlife and Fish Refuge is a vast expanse of land and water extending 285 miles between Wabasha, Minn., and Rock Island, Ill. The greatest impact on the river's environment is caused by USACE's maintenance of a 9 ft barge channel. USACE dredges millions of tons of slurry from the channel every year, and deposits the spoil on islands and other bottom-lands. USACE plans to deepen the channel to 12 ft. The multi-sided controversy over creating a wilderness to protect the refuge is discussed, with emphasis on positions taken by a citizen's action group, the U.S. Fish and Wildlife Service, and USACE.

Keywords: Dredging, Wildlife, Fish, Canalization, Minnesota, Wisconsin, Illinois, Refuges

SWANSON, S. D. 1976. The vascular flora and phytosociology of navigation Pool 8, the Upper Mississippi River. M.S. Thesis, Univ. of Wis., La Crosse, WI.

Abstract: Habitats examined were influenced by temporary or permanent inundation by the river. Dredging construction has added man-made habitats to this area which may not be inundated. Plants were collected in summer 1975 and spring 1976 totaling 2200 numbers of 4 to 5 specimens each. Identifications were made in conjunction with the LaCrosse Herbarium. Difficult-to-identify species were routinely collaborated by experts. A total of 380 species from 82 families were collected. The largest family was the Gramineae represented by 26 genera and 49 species. Carex (sedge) was the largest genera (21 spp.).

Taxon associations with other taxa and communities found were discussed.

Keywords: Vegetation, Pool 8, Upper Mississippi River, Dredging, Habitat alteration, Survey

SWENTKO, W. M. 1971. Determination of fall and winter fecal coliform densities in a slough of Pool No. 6 of the Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 46 p.

Abstract: Research on the bacterial contamination of the Mississippi River near Winona, Minnesota has been carried out since 1967. Studies have shown an increase in coliform density without a noticeable source in a slough formed by islands and sandbars off the main channel. It has been postulated that this section of the river between miles 718.8 and 718.0, with slower moving water and increased temperature due to shallowness and accumulation of nutrients and particulate matter, provides a site for the incubation of coliform bacteria. The present study was undertaken to test that hypothesis using fecal coliform density as the dependent variable. The slough was divided by three transects and samples were obtained from three positions at two depths on each transect. A control sampling site was established on the main channel of the river. Samples were collected over a four month period from November to February. Fecal bacteria were enumerated using the Millipore Membrane Filter Technique. Data obtained were subjected to statistical analyses using the analysis of variance, F-computation and Dunnett's Test.

Keywords: Bacteria, Slough, Pool 6, Research, Minnesota

TABAK, H. H. AND R. L. BUNCH. 1970. Mississippi River Basin Sterol Assay Project Report. Coprostanol, A Positive Molecular Marker of Domestic and Run-Off Pollution. Sterol Assay of Raw Sewage, Wastewater Plant Effluent and Surface Waters in the Burlington, Iowa Area on the Mississippi River. Federal Water Quality Administration, cincinnati, Ohio. Administration, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. 16 p.

Abstract: This study was undertaken to estimate the extent of human and warmblooded animal fecal pollution and to pinpoint the main sources of this pollution within a 3 mile radius of Burlington, Iowa on the Mississippi River. The survey covered seven sampling points, including raw sewage to the Burlington Wastewater Treatment Plant, the effleunt and surface water up and down stream from the treatment plant outfall. The analytical method used for the estimation of the coprostanol was based on the methodology which was previously developed by Murtaugh and Bunch and Proven effective for the recovery of sterols from wastewater as well as from a stream in the Cincinnati, Ohio area. The procedure consists of hexane extraction, mild alkali-alcohol hydrolysis of esters and conjugates to free parent sterols, cleanup by thin-layer chromatography and quantitative measurement by gas-liquid chromatography. Simultaneously with the assay for the fecal sterol, the number of fecal coliforms were determined utilizing the membrance filter technology.

Keywords: Pollution, Discharge, Urbanization, Research

TALAGA, B. J. 1971. Determination of total coliform density in a slough of Pool 6 of Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 42 p.

Abstract: The densities of total coliform bacteria at nine locations in a slough of Pool 6 of the Mississippi River were determined for eight days, 1971. The membrane filter technique was used. The statistical analysis of the data indicated that the population densities do not increase significantly while the water is in the slough; the bacteria do not tend to accumulate along either shore or in the midstream; bacterial densities remain fairly uniformly distributed between the surface and bottom water; and there tends to be a marked difference in coliform densities on different sampling days. This is due to differences in temperature of the water, current velocity, and turbidity of the water.

Keywords: Research, Bacteria, Pool 6

TEMTE, E. F. 1968. A brief history of the clamming and pearling industry in Prairie Du Chien, Wisconsin. pp. 1-37. Graduate seminar paper, Wisconsin State University, La Crosse, WI.

Abstract: A history of the pearl button industry near Prairie du Chien which describes the origin of the industry, damming, button cutting, pearling, and the decline and then revival of damming.

Keywords: Clams, History, Survey, Industry

TERPENING, V. A., L. J. HUNT, D. K. EVANS, S. J. BLEIWEISS And R. C. ZOANETTI. 1974. A survey of the fauna and flora occurring in the Mississippi Flood Plain between St. Louis, Missouri and Cairo, Illinois. Waterways Experiment Station. U.S. Dept. Army. Contract 4-74-3. 391 p.

Abstract: This report inventoried the littoral and terrestrial plant communities, the invertebrates of public health importance, amphibians, reptiles, birds and mammals. It attempted to explain the ecological relationships between plants and animals of each type of community. Assessments of any rare or endangered plants or animals were made with descriptions of ecological requirements. To evaluate recreational, commercial and aesthetic purposes of the land and the effects of impounding water for these purposes. Finally, suggestions were made for new or more detailed research.

Keywords: Survey, Vegetation, Illinois, Missouri, Wildlife, Rare species, Endangered species

TERPENING, V. A., J. R. NAWROT, M. J. SWEET, D. L. DAMRAU. 1975. Environmental Inventory and Assessment of Navigation Pools 24, 25 and 26, Upper Mississippi and Lower Illinois Rivers; Floodplain Animals and Their Habitats. Southern Illinois Univ., Carbondale Cooperative Wildlife Research Lab. Army Engineer Waterways Experiment Station, Vicksburg, MS. 285 p.

Abstract: Fauna and flora of the Mississippi floodplain between St. Louis, Missouri and Cairo, Illinois, were identified and described. Information was gathered through extensive reviews of literature, interviews, examination of collections, and field investigations.

Nine cover types were delineated in the unprotected floodplain. In general, immature plant communities were more diverse than mature communities. Totals of 302 species of plants, 53 species of mammals, 174 species and subspecies of birds, and 86 species of amphibians and reptiles were observed or expected to exist in the study area. Ecological relationships, successional trends, and land use in the study area were discussed.

Keywords: Upper Mississippi River, Illinois River, Pools 24-26, Ecology, Survey, Bibliography, Wildlife, Reptiles, Birds, Mammals, Invertebrates, Habitat, River lowland, Habitat alteration, Dredging, Dike, Sedimentation

THIEL, G. A. 1944. The geology and underground waters of Southern Minnesota, Minneapolis, Univ. Minn. Press.

Abstract: The purpose of the present investigation was to bring up to date the data on the subsurface geological structure and underground waters of southern Minnesota.

In this report an attempt is made to present sufficient data on the principles of occurrence and movement of ground water to give an engineer or contractor in charge of the development of a supply of water for a municipality or an industry an insight into some of the main concepts of hydrology. A comprehensive discussion of hydrologic laws cannot be included in a report of this type, but references are given to the more recent articles dealing with problems related to ground water.

Keywords: Minnesota, Hydrology, Geology

THOMERSON, J. E. and D. G. MYER. 1970. Corbicula manilensis: range extension upstream in the Mississippi River. Sterkiana 37:29.

Abstract: Clams taken from cooling system of Granite City Steel Co. Granite City, Illinois. Shell lengths are stated.

Keywords: Clams, Distribution, Benthos, Illinois

THOMFORDE, L. L. and C. R. FREMLING. 1968. Synchronous emergence of Hexagenia bilineata mayflies in the laboratory. Ann. Entomol. Soc. of Am. 61(5):1235-1239.

Abstract: Mass emergences of Hexagenia bilineata (Say) from the Upper Mississippi River tend to occur at intervals at about 6-11 days. It has seemed likely that the waves of emergence are indicators that sub-populations or "broods" have developed sympatrically and that the short-lived adults of one emergence peak are sexually isolated by the time from adults of preceding an succeeding peaks. However, preliminary experiments with laboratory populations showed that the progeny resulting from eggs laid during the time of one mass emergence will emerge at intervals and en masse over an 11-month period. It seems probable that the broods in the river may include adults from last-instar nymphs of varying ages which have emerged at the same time. Complete sexual isolation, discrete gene pools, and resulting sympatric speciation of the broods therefore seem unlikely.

Keywords: Invertebrates, Benthos, Upper Mississippi River, Life history, Mayflies

THOMPSON, D. H. 1933. The finding of very young Polyodon. Copeia, 1(1933):31-33.

Abstract: All the more direct evidence concerning the spawning of Polyodon is limited to the Mississippi River from the mouth of the Illinois to the mouth of the Ohio, a distance of about 200 miles. This stretch of river is swifter and more turbid than the Upper Mississippi, the Illinois, or the Ohio, where the adult spoonbill are most often taken. Commercial fishermen report the almost complete disappearance of the spoonbill from the Upper Mississippi following the construction of the Keokuk dam.

Keywords: Fish, Distribution, Paddlefish

THOMPSON, D. H. 1969. Feeding behavior of diving ducks on Keokuk Pool, Mississippi River. M.S. Thesis. Iowa St. U. of Sci. and Tech. Ames, Iowa.

Abstract: This project was started to:

1. Gather information on the population size and flock movement of ducks on the Keokuk-Fort Madison area during fall and spring.

2. Analyze food utilization of diving ducks to provide a basis for comparing pre- and post-dredging populations, feeding habits, food utilization, and harvest.
3. Gather data on the composition and size of the hunter-harvest on the Keokuk-Fort Madison area.

Keywords: Ducks, Pool 19, Food habits, Diving ducks

THOMPSON, D. H. 1977. Declines in populations of colonial waterbirds nesting within the floodplain of the Upper Mississippi River. Proc. 1977 Conf. of the Colonial Waterbird Group. 20-23 October. Northern Ill. Univ. pp.26-37.

Abstract: The present study was designed as a one-year pilot study to determine the colony locations and populations of larger colonial waterbirds nesting within the floodplain of the Upper Mississippi River. While 21 species presently breed or formerly nested north of St. Louis within the five states surrounding the study area, this report analyzes populations of only the six species of terns, cormorants, herons, and egrets which I actually found nesting within the floodplain. In addition, Least Terns are discussed because I was unable to find any, although they formerly nested within the study area.

Keywords: Population, Waterfowl, Flooding, Upper Mississippi River

THOMPSON, D. H. and G. W. BENNETT. 1938. Lake management reports - Horseshoe Lake near Cairo, Ill. Ill. Nat. His. Sur. Biol. Notes No. 8.

Abstract: This article gives an account of the changes which have taken place in Horseshoe Lake since its reconstruction in 1931. Measurements of fish populations and fish production were taken.

Keywords: Illinois, Population, Fish, Production

THOMPSON, D. H. and M. C. LANDIN. 1978. An aerial survey of the waterbird colonies along the Upper Mississippi River and their relationship to dredged material disposal. T.R. D-78-13. U.S. Army Eng. Waterways Exp. Sta. Vicksburg, Miss.

Abstract: Aerial surveys of 1040 km of the Upper Mississippi River, Locks and Dams 1-26, showed 35 active colonies of five species of larger waterbirds (great blue heron,

great egret, black-crowned night heron, double-crested cormorant, and Forster's tern) nesting in the floodplain. In addition, green herons and yellow-crowned night herons are reported as nesting, although location by aerial survey was not possible due to cryptic coloration and nest placement beneath the tree canopy. No species were found nesting on dredged material. In general, colonies were located on isolated insular natural sites on the east side of the river below dams and/or tributaries. Dredged material sites were found to be unsuitable for nesting because of high human recreational use of dredged material and the early succession of vegetation stages present.

Keywords: Survey, Waterfowl, Dredging

THOMSON, C. M. and R. E. SPARKS. 1977 Status of the Fingernail clam. 39th Midwest Fish and Wildlife Conference, Dec'77 in Madison, WI.

Abstract: In July, 1973, the Illinois Natural History Survey began studying the population dynamics of the benthic macroinvertebrates in Keokuk Pool, Mississippi River. The heavy utilization of the Pool by diving ducks and the high production of fish are both based on the unusual abundance of benthic food organisms, primarily the fingernail clam, Musculium transversum.

Seven sampling stations were established in the lower 16 miles of Keokuk Pool. Five Ponar dredge samples were collected from each station at monthly intervals from July, 1973 to the present.

Keywords: Duck, Flow, Iowa, Fingernail clam, Pool 19

THORNBURG, D. D. 1971. Flock behavior of diving ducks on Keokuk Pool, Mississippi River. M.S. Thesis, Iowa State Univ, Ames, IA. 64 p.

Abstract: This was a study to determine the patterns of local movements of diving ducks. The most abundant species were lesser scaup, canvasbacks, and ringnecked ducks. Peak populations were during the first week of Nov.

Human disturbance was the main factor inducing mass movement between sections. Light intensity was probably responsible for daily movements.

Keywords: Behavior, Ducks, Waterfowl, Diving ducks, Movement, Pool 19

THORNBURG, D. D. 1973. Diving Duck Movements on Keokuk Pool Mississippi River. J. Wildl. Manage. 37(3):382-389.

Abstract: A study was initiated in 1969 to determine the patterns and causes of local movements of diving ducks on the Keokuk Pool and to relate diurnal activity to hunter harvest and food availability. Within a week of arrival, diving ducks on the Keokuk Pool established a diurnal rhythm of movement. The general pattern was a morning flight at dawn from the highly disturbed middle and upper sections to the less disturbed lower section where birds loafed throughout the day. A return flight upstream to choice feeding areas in the middle and upper sections occurred at dusk. Over 60 percent of the population using the pool participated in this daily movement. Human disturbance was the major factor inducing mass movements to the lower segment and a concurrent decrease in use of areas in the middle and upper sections was correlated with the opening of the hunting season. Minimal feeding occurred on the pool during the day. Birds fed extensively at night in the middle and upper sections of the Keokuk Pool. Areas in the middle and upper sections were more productive in bottom invertebrates than areas in the lower section. In general, the distribution of diving ducks was correlated with the greatest abundance of benthic organisms used for food.

Keywords: Ducks, Invertebrates, Pool 19, Movement, Behavior, Diving ducks

THRALL, J. H. 1964. Analysis of phytoplankton in Weaver Pond, Winona, MN. B.A. Thesis, St. Mary's College, Winona, MN. 23 p.

Abstract: A differential count made on the samples is given in Table 5. Results are given as an average, as no significant difference could be noted between the three stations. Table 3 gives the fluctuations in total number of plankton. Counting was done on a Sedgewick-Rafter cell.

Seasonal succession patterns are also shown.

Keywords: Weaver Bottoms, Phytoplankton, Survey, Minnesota

THRUNE, S. V. 1973. Bank and rough-winged swallow use of the Mississippi River near Monticello, Minnesota. M.S. Thesis, St. Cloud Univ., St. Cloud, MN. 48 p.

Abstract: This was to study the use of the Mississippi River by bank and rough-winged swallows. The study was four miles around a nuclear plant, near Monticello, Minnesota from June 1971 to September 1972. Birds were banded and recaptured. During 1972 recapture showed dispersal of birds from 1971 and a marked habitat preference near rapids upstream from the plant. No plant effects were found.

Keywords: Birds, Survey, Minnesota, Distribution, Swallows, Nuclear power

TIFFANY, J. B. 1963. Review of Research on Channel Stabilization of the Mississippi River 1931-1962. Committee on Channel Stabilization (Army) 123 p.

Abstract: The paper attempts to describe most or all of the laboratory and field investigations on channel stabilization which have been conducted by the Waterways Experiment Station from about 1931 to the date of writing, and certain investigations which have been conducted by the Mississippi Valley Division. Several investigations are described which were conducted jointly by the Mississippi River Commission, the LMVD District, and the Waterways Experiment Station. Included are descriptions of independent field investigations, independent laboratory investigations, and coordinated field and laboratory investigations.

Keywords: Channel maintenance, Hydrology, Models, Dredging

TIFFANY, J. B. 1950. Turbulence in the Mississippi River. Potam. Rept. No. 10-2, U.S. Army Waterways Exp. Sta., Vicksburg, Miss.

Abstract: This paper describes the results obtained to date of a pioneer investigation being conducted by the Mississippi River Commission and the Waterways Experiment Station, Corpt of Engineers, to measure turbulence in the Mississippi River. Included in the paper are descriptions of the development of instruments used for taking the measurements and of examples of the data, principally those obtained during the 1950 flood stages on the Mississippi River. The paper does not attempt a statistical and scientific analysis of the data, since there has not yet been time for such analysis, but outlines proposed continuations of the program which will include such analysis.

Keywords: Turbidity, Equipment

TIFFANY, L. H. and M. E. BRITTON. 1952. The algae of Illinois. Univ. of Chicago Press, Chicago. 407 pp.

Abstract: This volume supplements "A Catalog of Illinois Algal" and furnishes descriptions, keys and figures to the Illinois species of algae.

Keywords: Phytoplankton, Illinois, Limnology, Species list

TILLMAN, A. G. 1928. The Mississippi Gorge: successive adjustments to the environment, La Crosse, Wisconsin to Winona, Minnesota.

Abstract: Historical descriptions of various societies that have enhabited the area, their effect on the land and each other, and the environment's influence on the societies.

Keywords: History, Ecology

TODD, J. H. 1942. A contribution to the study of Pleistocene history of the Upper Mississippi River. Ph. D. Thesis, University of Minnesota.

Abstract: Drill records have shown that the valley of the upper Mississippi River, south of the Falls of St. Anthony at Minneapolis, Minnesota, was once much deeper than it is at the present time, and that the true canyon-like proportions of this valley are concealed by alluvium which not uncommonly attains a thickness of 150 feet or more. Deep borings made by the United States Engineers at numerous lock and dam sites along this section of the river have provided an opportunity for a study of the gorge and especially of the alluvium which partially fills it.
The purpose of this study was three fold: (1) to determine the nature and possible source of the alluvial fill, (2) to see what significant information such a study might yield regarding the history of the gorge itself, and (3) to estimate the possible value of further and more detailed investigations.

Keywords: History, Upper Mississippi River, Research

TOMLINSON, H. D. 1971. Temperature conditions and taste and odors in the Mississippi River. Rychman, Edgerley, Tomlinson and Associates (RETA), St. Louis, RETA Project No. 948.

Abstract: A study which documented water temperatures in the vicinity of several water treatment plants along the Iowa border of the Mississippi River.

Keywords: Thermal effluent, Temperature, Pools 15, 19 and 26, Water quality, Iowa

TORBORG, U. A. 1970. An estimate of the production rate of Stephanodiscus nigarae from mud and sand substrates at varying depths within a slough of the Upper Mississippi River, Pool 6. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: Research on the benthic plankton production was carried out in the Blacksmith slough of the Upper Mississippi River Pool 6 near Homer, Minnesota. The organism used to determine production was Stephanodiscus niagarae. Samples were collected and tabulated for 2 six-day periods as one phase of a whole series of experiments carried out on this area.

Keywords: Phytoplankton, Primary production, Sediment, Slough, Pool 6, Upper Mississippi River

TOWELL, B. 1958. Freshwater cancer. Mo. Conserv. 19(9):1-3.

Abstract: Pollution is often referred to as the cancer of fresh water. Pollution is the dark side in the future of fishing and other recreational uses. Water pollution kills fish and other aquatic life, it lowers the fish supporting capacity of water and renders the water unfit for recreation.

Keywords: Pollution, Fishing

TOWNSEND, H. 1902. Statistics of the fisheries of the Mississippi River and tributaries. Rept. U. S. Comm. Fish. for 1901. Appendix 15, pp. 659-740.

Abstract: A detailed report on the fishery statistics of Mississippi River states giving comparisons of fishing methods, the amount of capital invested in fisheries, and dollar values of various fish species.

Keywords: Commercial fishing, Survey, Harvest

TOZZI, J. T. 1976. Swift-Running Rivers Work Group Formal Reports Pertaining to Investigations and Analyses Performed

between June 1974 and August 1975. Coast Guard, Washington, D.C. Office of Research and Development. 39 p.

Abstract: This report contains the two formal reports which were generated by the Swift-Running Rivers Work Group during its tenure, between June 1974 and August 1975. The Group was formed in response to a mandate from the Chief of Staff of the U.S. Coast Guard to investigate what appeared to be major aids-to-navigation problems in the Western Rivers System of the United States and to recommend a long-term R and D approach to their solution.

Keywords: Hydrology, Navigation

TRAUGER, D. L. 1974. Color Marked Canvasbacks. Loon 46(4):160

Abstract: Canvasbacks marked with colorful plumage dyes were recently released at key migrational concentration areas in the North Central states by wildlife research biologists of the U.S. Fish and Wildlife Service. The purpose of the color-marking program is to determine the migrational dispersal and wintering distribution of Canvasbacks staging on the Upper Mississippi River.

Keywords: Upper Mississippi River, Waterfowl, Migration, Ducks, Distribution, Diving ducks, Methods, Tagging, Canvasback

TRAUTMAN, M. B. 1931. Notropis volucellus wickliffi, a new subspecies of cyprinid fish from the Ohio and Upper Mississippi rivers. Ohio J. Sci., 31(6):468-474.

Abstract: In this paper three northern forms of this species are differentiated and their ranges and habits discussed and defined.

Keywords: Cyprinids, Fish

TRAUTMAN, M. B. 1956. Carpiodes cyprinius hinei, a new subspecies of the carpsucker from the Ohio and Upper Mississippi river systems. Ohio J. Sci., 56(1):33-40.

Abstract: Many species of Carpiodes have previously been described but since none of the previous names may be applied with any degree of certainty to the interior population of C. cyrinus, Trautman proposed C. cyprinus hinei.

Keywords: Carp, Fish

TRAUTMAN, M. B. and R. G. MARTIN. 1951. Moxostoma aureolum pisolabrum, a new subspecies of sucker from the Ozarkian Streams of the Mississippi River system. Occas. Pap. Mus. Zool. Univ. Mich. 534:1-10.

Abstract: A new subspecies of sucker, whose range is centered in the Ozark region is described. Included in the paper is a discussion of types, color descriptions, habitat, breeding, and integradation.

Keywords: Fish, Habitat

TROXEL, C. E. 1939. An economist dissects the Upper Mississippi waterway. Railway Age 107 (16 Sept. 1939): pp. 403-405.

Abstract: The nine-foot waterway on the Upper Mississippi is not only expected now to be more costly than the Ohio river improvements, but also the current estimate of the cost is much higher than the original estimate.

Keywords: Nine-foot channel

TSAI, C. F. and E. C. RANEY. 1974. Systematics of the Banded Darter Etheostoma zonale Pisces Percidae. Copeia (1): 1-24.

Abstract: Etheostoma zonale is redescribed and variation patterns are analyzed. Geographical variation indicates the existance of two subspecies, Etheostoma zonale zonale (Cope) and Etheostoma zonale lynceum (Jordan). The former is found in the Mississippi River drainages above the Fall Line, western drainages of Lake Michigan and headwaters of the Savannah River on the Atlantic slope. The latter occurs in eastern tributaries of the Lower Mississippi River, below the Fall Line, and in eastern Gulf slope drainages in Mississippi and Louisiana. The geographical origin of the species and its dispersion routes are postulated.

Keywords: Fish, Systematics, Banded darter

TURNER, W. M. 1977. The ectoparasites and disgestive tract parasites infecting three species of Catostomidae in the Mississippi River near Becker, Minnesota. M.S. Thesis, St. Cloud Univ., St. Cloud, MN.

Abstract: The ectoparasite and digestive tract parasites infecting Moxostoma macrolepidotum, Moxostoma anisurum, and Catostomus commersoni were quantitantively and qualitatively determined to acquire preoperational data on the portion of the Mississippi River near the site of Northern States Power Company's Sherburne County Generating Plant.

Eighty-eight fish were necropsied from 1 June 1975 through 13 November 1975. These fish were taken with electrofishing gear and were processed in the field. Gill arches, eyes, digestive tracts, and fins were removed and taken to the laboratory for examination.

Of the 88 fish examined, 95.4% were in some way parasitized with an average intensity of 54.6 parasites per host. Parasites were found infesting 95.6% of M. macrolepidotum, 100% of M. anisurum, and 90% of C. commersoni.

Keywords: Fish, Disease, Parasites

TUTHILL, S. J., B. E. HOYER and J. C. PRIOR. 1972. Report to the Iowa State Conservation Commission of the Mississippi River overflight to identify sources of warm effluent. Iowa Geological Survey. Feb., 1972.

Abstract: Visual and photographic record was made of all open areas on the Mississippi River between Keokuk, Iowa, and the Minnesota-Iowa border. The purpose of the survey was to identify points on the river at which warm effluents are being discharged.

Keywords: Thermal effluent, Survey, Iowa, Discharge, Remote sensing

TUTHILL, S. J., B. E. HOYER and J. V. TARANIK. 1972. Thermal remote sensing on the Mississippi River in Iowa. AICHE Water Sym. Series 69:391-400.

Abstract: On 4 June 1971, the Iowa Conservation Commission, Commonwealth Edison, and the Iowa Geological Survey studied the surface temperature distribution of the Mississippi River bordering Iowa. Airborne thermal mapping data was collected along a 180-mile length of river concurrent with surface measurements at 13 preselected areas. Density slicing the thermal imagery provided a method for generating an isothermal map. Results indicate further refinement of thermal mapping

techniques could rapidly produce accurate thermal maps for complete river systems.

Keywords: Thermal effluent, Temperature, Survey, Iowa

TWAIN, M. 1962. Life on the Mississippi. Oxford Univ. Press, New York. 429 p.

Abstract: An account of history of the river with its explorers, rivermen and legends. A personal story of the life of Mark Twain and his relationship with the river.

Keywords: History

UNDERHILL, J. C. 1957. The distribution of Minnesota minnows and darters. Occas. Pap. Minn. Mus. Nat. Hist. No. 7, 45 p.

Abstract: This study of the distribution of the minnows and darters of Minnesota had a twofold purpose: first, to obtain a more detailed picture of the distribution of the individual speices; and second, to determine whether their distributions could be correlated with the known postglacial chronology of the state.

Keywords: Fish, Distribution, Minnesota

UTTERBACK, W. I. 1915. The Naiades of Missouri. Am. Midl. Nat. 4(3):41-533.

Abstract: Catalogue of naiads of Missouri including discussion of animal characters, shell characters, nutritive structures, reproductive structures, external and internal structures and miscellaneous remarks.

Keywords: Invertebrates, Missouri, Species list, Anatomy, Physiology

VAN DER SCHALIE, H. and J. BATES. 1976. A survey of fresh-water mussels near a proposed power plant site. Conducted for Iowa-Illinois Gas and Electric Company, Davenport, Iowa.

Abstract: Historical background, location of mussel beds, commercial harvest and list of threatened and endangered species.

Keywords: Mussels, Iowa, Survey, Benthos, Power, Distribution, Endangered species

VAN DER SCHALIE, H. and A. VAN DER SCHALIE. 1950. The mussels of the Mississippi River. Am. Midl Nat. 44(2):448-466.

Abstract: An account of the distribution of mussels throughout the productive area of the main stream of the Mississippi River. The result of a comprehensive survey by Max Ellis during 1930 & 31.

Keywords: Survey, Mussels, Distribution, Benthos

VANDERVOORT, T. J., and K. A. DENISEN. 1976. Minneapolis - St. Paul: Land of the "Shining Big-Sea-Water". J. Water Pollut. Control Fed. 48(9):2107.

Abstract: Establishment in 1969 of a regional metropolitan waste control commission in the seven-county region of Minneapolis - St. Paul has led to dramatic improvement in wastewater treatment plant performance in the area, treatment improvement, construction programs, research studies, and funding methods accomplished by the commisssion from 1970-76 are discussed. In 1975, water quality in the region was generally excellent; DO concentrations in the Mississippi, Minnesota and St. Croix rivers were never below the 5 mg/l standard.

Keywords: Water quality, Ecology, Survey, Urbanization

VARCHMIN, T. E. 1969. A study of autumn food habits of five game fish in Pool 6 of Upper Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 34 p.

Abstract: During the summer of 1966, the spring of 1967, and the autumn of 1968, research was carried out to determine what specifically constitutes the diets of three common game fish--the largemouth bass (Micropterus salmoides Lacepede), the black crappie (Pomoxis nigromaculatus LeSeur), and the northern pike (Esox lucius Linn).

Keywords: Fish, Pool 6, Food habits, Research

VASEY, F. W. 1965. Age and growth of walleye, Stizostedion vitreum (Mitchell), and sauger, Stizostedion candense (Smith), in Pool 11 of the Mississippi River. M.A. Thesis, Iowa State Univ., Ames, IA. 52 pp.

Abstract: This report analyzes the life history from tagging studies near Guttenberg, Iowa. Plastic imprints of the walleye and sauger scales were made. Female walleyes and saugers were more abundant than males. Length-weight regressions were also different between males and females.

Keywords: Age and growth, Pool 11, Fish, Walleye, Sauger

VASEY, F. W. 1967. Age and growth of walleye and sauger in Pool 11 of the Mississippi River. Iowa State J. Sci., 41(4):447-466.

Abstract: Walleyes, Stizostedion vitreum (Mitchill), and saugers, S. canadense (Smith), were collected with an electric shocker below Lock and Dam 10 in the Mississippi River in April 1957, 1958, 1959, 1961 and 1962 by the Iowa Conservation Commission. Female walleyes and saugers were more abundant than males in the collections except in 1961. Collection at various stages of the spawning period probably caused the variation in sex ratios and length frequencies for different years. Condition factors differed significantly between sexes and species but not between years of collection. The mean condition factors were 41.8 for female walleyes, 36.9 for males, 37.4 for female saugers and 33.7 for males. In each group weight increased more rapidly than the length cubed. Females grew more rapidly than the males after the third year of life. The oldest male walleye was age V compared with Age XI females. The oldest female saugers were only one year older than the oldest males, Age VI. Selective sampling and use of direct proportion for calculating previous lengths were probably causes of Lee's phenomenon. Growth rates of both species in Pool 11 were faster than averages reported in most other waters, but not as rapid as in new reservoirs.

Keywords: Age and growth, Pool 11, Fish, Walleye, Sauger

VIDAL, P. J. 1959. Fishing that Old Man River. Outdoors in Ill., Spring and Summer.

Abstract: The Mississippi River has been overlooked by many Illinois fishermen. This is in part, due to the lack of publicity, the absence of public access areas and boat launching facilities along the river, and the attraction of other better-known and publicized fishing areas in and about the state. But these problems are being worked on and soon fishing should be as popular in Illinois Mississippi waters as in those other states.

Keywords: Sport fishing

VIRNIG, T. T. 1971. Determination of mercury concentrations in rough fish from Pool 6 of Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 31 p.

Abstract: Rough fish were taken through the cooperation of commercial fishermen operating in the Trempeleau Bay area of Pool Six of the Mississippi River. Mercury concentrations on a wet weight basis were determined by Atomic Absorption Spectrophotometry. Fish sampled were below the 0.5 ppm FDA standard, except for one fish which assayed 0.66 ppm. Mercury content is not considered to be a problem in this area since the average for all the fish sampled was 0.12 ppm.

Keywords: Pool 6, Chemistry, Fish, Heavy metals, Toxicant

VOLLENWEIDER, R. A. 1969. A manual on methods for measuring primary production in aquatic environments. F. A. David Co., Philadelphia. 213 pp.

Abstract: This book produces a simple outline of techniques already established for primary productivity studies. Emphasis has been given to a critical review of techniques rather than to a set of standard procedures to be used in all situations.

Keywords: Phytoplankton, Primary production, Aquatic plants, Methods

WAELTI, J. J. 1974. Flood Control, Navigation, and Other Alternative Water Resources Policies in Minnesota. Minnesota Univ., Minneapolis. Water Resources Research Center. Office of Water Resources Reserach, Washington, D.C. 27 p.

Abstract: Research was carried out in three areas of water resources in Minnesota: flood control, navigation, and general water policies. Research results indicate that governmental units were the ultimate bearers of nearly half of the flood costs in the Minnesota River Basin in the 1965 and 1969 floods. The current issues in commercial navigation which affect Minnesota basically involve a resolution of the conflict between developmental and environmental values. Without maintenance dredging, barge traffic would come to a halt on the Upper Mississippi causing irreparable economic harm. With a system of barge user charges in effect, environmental values would be better accounted for and barge transportation will be assigned to its most efficient position in the national transportation system.

Keywords: Minnesota, Flood, Navigation, Dredging, Ecology, Commercial boat traffic

WAELTI, J. J. and R. C. LEWIS. 1971. The Water Quality Controversy in Minnesota and the Marginal Costs of Alternative Levels of Water Quality in the Upper Mississippi River. Minnesota Univ., Minneapolis. Water Resources Research Center. 22 p.

Abstract: The water quality controversy generally, and specifically in the Minneapolis-St. Paul area is discussed. The controversy centers around: the methods of obtainint various levels of water quality, the level of water quality that should be attained, and the institutional means of instituting policy. A linear programming model was used to find the lowest cost methods of achieving alternative dissolved oxygen levels in the Mississippi River in the Minneapolis-St. Paul area.

Keywords: Upper Mississippi River, Water quality, Urbanization, Models, Minnesota

WAGGNER, J. P. and K. CAPPEL. 1971. Concept Development Program for Icebreaking on the Upper Mississippi River. Franklin Inst. Research Labs. Philadelphia, PA. 270 p.

Abstract: A number of concepts were considered for cleaning a channel in the Upper Mississippi River. All of those concepts considered feasible utilized an upward breaking bow of shallow angle in combination with a conveyor or system for placing cleared ice well back from the channel. The use of impact or mechanical cutters, jets, projectiles, heat and several other forms of ice management aids were reversed. Two concepts, one using a fixed underwater scoring device and the other using a mobable impactors on top of the ice, were in the final selection process.

Keywords: Channel maintenance, Navigation, Upper Mississippi River, Ice

WAGNER, G. 1908. Notes on the fish fauna of Lake Pepein. Trans. Wis. Acad. Sci. Arts Letts. 16(1):23-37.

Abstract: Lake Pepin was used to experiment with the introduction of certain food fishes not now existing there, especially certain whitefish.

Keywords: Lake Pepin, Minnesota, Fish

WALKER, C. R. 1964a. Toxicological effects of herbicides on the fish environment. Water and Sewage Works, 3(3) (Part 1):113-116.

Abstract: Investigations were made on toxicological effects of herbicide on the fish, on fish habitat, on herbicides themselves, and on the degradation of residues in water and fish flesh.

Keywords; Herbicides, Toxicant, Fish, Biological alterations

WALKER, C. R. 1964b. Toxicological effects of herbicides on the fish environment. Water and Sewage Works. 3(4) (Part 2):173-175.

Abstract: The treatment of a plant-infested body of water with a weak control chemical caused a drastic change in the natural ecology.

Keywords: Herbicide, Toxicant, Fish

WALKER C. R. 1965. Diuron, fenuron, monuron, neburon, and TCA mixtures as aquatic herbicides in fish habitats. Weeds, 13(4):297-301.

Abstract: The substituted urea herbicides were rated according to their effectiveness as aquatic herbicides in this order: diuron, monuron, neburon and TCA mixtures with them. They showed the greatest potential in controlling certain aquatic plants in preemergence and early postmergence applications. However, relatively high concentrations were required to control filamentous algae, chara, coontail, naiad and pondweeds for 3 months and up to 3 years. Granular formulations achieved better distribution of herbicides for control of rooted aquatic plants along the margins of lakes and ponds.

Keywords: Herbicides, Toxicant, Fish, Habitat

WALLACE, J. 1958. How to fish the Upper Mississippi. Mo. Conserv., August.

Abstract: Waters of the upper Mississippi are something of a hybrid - neither completely river nor lake but something of both. The baits and lures used for different fish are discussed. Because weather and water can be rough at times, a safe sturdy boat is very necessary.

Keywords: Fishing, Upper Mississippi River

WALSH, D. 1968. The Mississippi River Outflow, Its Seasonal Variations and its Surface Characteristics. Ph.D. Thesis, Texas A & M University. 238 pages.

Abstract: In the past, physical oceanography investigations in the Mississippi Delta area have concentrated primarily on specific phenomena in limited areas. No known attempt has been made to treat river discharge into the ocean as a dynamic system having mean variations in its physical properties. This investigation provides a tentative description of mean seasonal and monthly outflow patterns together with an analysis of the factors that shape them. Pertinent historical and contemporary data are limited and this effort is only a first approximation of actual conditions. It is shown that averaging of several years' data can provide acceptable working values of the pertinent properties such as river outflow, wind field, sea surface temperature, etc.

Keywords: Hydrology

WARREN, P. T. 1967. The primary food source of game fish of the Upper Mississippi River during autumn. B.A. Thesis, St. Mary's College, Winona, MN. 21 p.

Abstract: The main purpose of this study was to find out what the main food sources of the game fish in the Upper Mississippi Valley were during the autumn months. In this study special consideration was given to the gizzard shad, Dorosoma cepedianum, because of its abundance and reputation as a forage fish in this area. An electrical apparatus called a shocker was used to collect the fish.

Keywords: Upper Mississippi River, Food habits, Fish, Gizzard shad

WATERS, S. 1976a. Area Survey-Mississippi River, 1976. Steamboat Slough (R.M. 503-505.6, Pool 14) and Rush Chute (R.M. 406-410.4, Pool 19). Iowa Cons. Comm. Proj. No. 76-III-C-14-. pp. 47-53.

Abstract: The objectives of this survey were to get an initial look at the river's fishery, mussel populations, habitat types and sampling methods. The investigation involved one area in Pool 14 and one area in Pool 19.

Keywords: Survey, Slough, Pools 14 and 19, Iowa, Fish, Mussels, Habitat, Methods

WATERS, S. 1976b. Expandable Creel Survey Below Lock and Dam 16, Mississippi River, Mississippi River (Pool 17), Muscatine County. Iowa Cons. Comm. Proj. No. 76-III-C-15. pp. 54-68.

Abstract: This creel survey should supply some needed information on harvest, fishing pressure and fishing methods, as well as introducing the river's fishery to area fishery personnel.

Keywords: Survey, Creel census, Lock and Dam 16, Pool 17, Iowa, Fish management, Harvest, Pressure

WATERS, S. 1977. Freshwater Mussels of the Upper Mississippi River Pools 14-19. Iowa Cons. Comm. Proj. No. 77-III-p-18. pp. 120-130.

Abstract: The objectives of this study were to (1) map existing clam beds and collections sites; (2) detemine the species of clam collected; and (3) develop a clam identification board.

Keywords: Mussels, Upper Mississippi River, Pools 14-19, Iowa, Species list, Survey, Taxonomy, Distribution

WATKINS, P. 1969. Yearly macroinvertebrate production as relative to organic pollution on Upper Mississippi River. M.S. Thesis, St. Mary's College, Winona, MN. 116 p.

Abstract: Trichoptera (67%) and Diptera (19%) were the largest producing orders for one year. Cheumatopsyche campyla (Trichoptera) represented 36%. Hydropsyche orris represented 27%. This study suggested using benthos as indicators of pollution. Samples were collected fall 1966 through summer 1967. It was found that yearly macroinvertebrate production was larger on the Minnesota side of the river which was attributed to organics from Winona. There existed a definite correlation between total coliform and macroinvertebrate populations on the Upper Mississippi River.

Keywords: Invertebrates, Pollution, Benthos, Minnesota, Upper Mississippi River, Bacteria, Productivity, Indicator

WAUCHOPE, R. D. 1975. 1975. Fixation of Arsenical Herbicides, Phosphates, and Arsenate in Alluvial Soils. J. Environ. Qual., 4(3):355.

Abstract: The sorption of arsenic, phosphate, disodium methanearsonate, and the sodium salt of cacodylic acid by 16 Mississippi River alluvial flood plain soils is measured in a slurry experiment in which initial pH and molar solution concentrations for all four solutes are identical. Sorption of the two organoarsenical herbicides is strongly correlated with arsenate and phosphate sorption, and sorption of all four species is strongly correlated with clay and iron oxide contents of the soils.

Keywords: Herbicides, River lowland

WAYMAN, N. L. 1971. Life on the river. Crown Publishers, Inc., New York. 327 p.

Abstract: The history of the Mississippi Valley and its river system is the story of the development of our nation's vast midwestern heartland. In the valley's progress from a lush wilderness, inhabited by savage Indian tribes, to the sophisticated civilization of today, the steamboat played a major role. This book illustrates

and describes that progress and its multifaceted life, on the boats and along the rivers.

Keywords: History, Development

WEBBER, O. K. 1977. Diatom populations observed on artificial and natural substrates in the Mississippi River near Monticello, MN. M.S. Thesis, St. Cloud Univ., St. Cloud, MN.

Abstract: Diatom algae in the Mississippi River near Monticello, Minnesota were studied during 1976. Three basic objectives of the study were: (1) to develop a comprehensive listing of the diatom flora of this region; (2) to study the variation of the artificial substrate communities; and (3) to compare artificial and natural substrate communities.

During 1976, 143 taxa of diatoms were observed. Surface sample counts showed dominance percentages of individual species which could be separated into four categories. One category included species having a unimodal peak of occurrence. Cocconeis placentula var. euglypta dominated the first four months of the study, June through Septembe. Diatoma vulgare dominated the October sample. Other species displaying a unimodal peak of occurrence included Navicula gracilis and Achnanthes linearis. Another category included those species having a bimodal peak of occurrence. These included Gomphonema parvulum and Achnanthes minutissima. The next category consisted of those species of consistent occurrence, but having no obvious peaks in their populations. The last category were those species of rare occurrence. These included two unknowns, Gomphonema sp. and Nitzschia sp.

Keywords: Phytoplankton, Survey, Population, Minnesota, Species list

WEFRING, D. R. 1976. Invertebrate drift over a five-day period in the Mississippi River near Becker, Minnesota. M.S. Thesis, St. Cloud State University. St. Cloud, MN. 79 p.

Abstract Drifting invertebrates were collected from the Mississippi River near Becker, Minnesota, at five stations for five consecutive days during July, 1975. Data were acquired on the drift fauna composition, magnitude, daily fluctuation, diel fluctuation and general distribution which included a statistical analysis of the

horizontal and vertical distribution to provide a baseline of information on drift in this area. Deep water sampling gear was designed and used in conjunction with other drift samplers to permit sampling a cross-section of the river.

Sixteen orders of aquatic macroinvertebrates were represented in the drift samples. Trichoptera (28%), Ephemeroptera (15%) and Diptera (56%) were the dominant orders of organisms collected. The percentage composition of the entire drifting population remained relatively stable. Although the population composition differed between stations, each station remained fairly constant with respect to its composition. Daily drift rate estimates ranged from 27 x 10^6 to 33 x 10^6 no./24 hours. Day-to-day and diel fluctuations in the drift density were quite evident. A far greater number of organisms were collected during the night than during the day, with the exception of the midstream station where Simulium larvae were collected in large numbers, continuously throughout each of the five 24-hour periods. The distribution of the drifting organisms appears to be primarily influenced by current velocity and water depth. Drift densities of selected groups were rarely found to be horizontally or vertically uniformly distributed within the river cross-section.

Keywords: Minnesota, Invertebrates, Behavior, Distribution, Movement

WEHRLE, F. F. 1963. Rend Lake Reservoir Upper Mississippi River Basin Big Muddy River, Illinois. Army Engineer District, St. Louis, MO. 343 p.

Abstract: Contents: I - Project authorization; II - Investigations; III - Local cooperation and views of local interests; IV - Location of project and tributary area; V - Project plan; VI - Departures from project document plan; VII - Hydrology; VIII - Geology; IX - Soils and foundation design; X - Other plans investigated: XI - Description of proposed structures and improvements; XII -Hydroelectric power study; XIII - Sources of construction materials; XIV - Reservoir management and public use; XV - Real estate requirements: XVI - Relocations; XVII - Cost estimates; XVIII - Schedules for planning and construction; XIX - Operation and maintenance; XX - Reservoir regulation; XXI - Health control; XXII - Economic analysis.

Keywords: Upper Mississippi River, Big Muddy River, Reservoir, River lake, Hydrology, Geology, Dam

WELCH, R. M. 1977. The cleanup of Lake Winona. Parks and Rec. May, 1977: 39-41, 78.

Abstract: Lake Winona needed rehabilitation due to its eutrophic condition. The stratification of the lake caused winter kills of fish and rough fish were dominating the lake fishery. A cooperative effort was initiated to make the lake more recreational. The following steps were taken:

1. Six submerged aerators were installed to circulate the lake water to prevent winter kills.
2. An electric weir was installed to prevent rough fish from re-entering the lake.
3. A total fish kill to remove undesirable rough fish.
4. Restock the lake with desirable game and pan fish.
5. Provide parks, fishing piers, and a bike path for community use.

Keywords: Minnesota, Recreation, Development

WELLBORN, T. L. and W. A. ROGERS. 1966. A key to the common parasitic protozoans of North America. Auburn Univ. Zool. -Ent. Series, Fish. 4:17.

Abstract: An identification guide to parasitic protozoans with descriptions of distribution, breeding, and life histories.

Keywords: Keys, Parasites, Protozoa, Species list

WENKE, T. L. 1965. Some ecological relationships of mayflies, caddisflies and fish in the Mississippi River near Keokuk, Iowa. Ph.D. Thesis, Iowa State Univ. of Science and Technology, Ames, IA.

Abstract: Mayflies and caddisflies emerge from the Mississippi River in such numbers as to cause health or traffic hazards in many localities. The principle nuisance species are the caddisflies, Hydropsyche orris Ross, Cheumatopsyche campyla Ross and Potarmyia flara Hagen and the mayfly, Hexagenia bilineata Say.

Keywords: Invertebrates, Fish, Food habits, Iowa, Mayflies, Caddisflies, Pool 19

WENKE, T. L. 1967. Caddisfly (Trichoptera) collections from the Mississippi River at Lock and Dam 19. Iowa State J. Sci. 42(1):43-6.

Abstract: Light trap collections at Lock 19 on the Mississippi River at Keokuk, Iowa, June 15, to August 22, 1961, included 14 apecies of Trichoptera with Cheumatopsyche campyla, Hydropsyche orris, Cyrnellus mariginalis and Potamyia flava being the most abundant in that order. Others constituted less than 0.5%. The first two showed little seasonal trend but Potamyia was most abundant in late June and Cyrnellus in August.

Keywords: Lock and Dam 19, Invertebrates, Caddisflies

WENKE, T. L. 1968. Abundance of Crepidostomum and other intestinal helminths in fishes from Pool 19, Mississippi River. Iowa State J. Sci., 43(2):211-222.

Abstract: From 1961 through 1963, digestive tracts of 28 species of fishes were examined for helminth parasites. Trematodes were numerically the most important. Adult Crepidostomum ictaluri were identified in seven species, C. cooperi in one, and C. illioniense in three. The blue catfish, flathead catfish, and white crappie evidently represent new definitive host records, the first species for C. ictaluri, and the other two for both C. ictaluri and illioniense.

Adult Crepidostomum have little or no significant deletrious effects on the fishes. Rediae and cercariae are harbored by Sphaerium transversum, but the percentage of infection is low. Hexagenia naiads host the metacercariae, but deleterious effects are probably unimportant.

Keywords: Abundance, Fish, Parasites, Pool 19

WICKS, J. L. 1930. Pollution of the Upper Mississippi River. Trans. Am. Fish. Soc., 60:286-296.

Abstract: Discusses the effects of the sewage of the Twin Cities on the Mississippi River and two wildlife refuges in the vicinity.

Keywords: Pollution, Wildlife, Minnesota, Habitat alteration, Refuges

WIDNEY, S. 1962. Historically speaking, Muscatine, button capital of the world (in the Gay Nineties). Iowa Conserv., 21(4):31.

Abstract: Clamming started as a good business in 1889 when clam shells were sold for buttons in Muscatine. The "boom" lasted only about ten years when the button market became overstocked and the mussel beds had almost petered out. Buttons are still manufactured in Lansing, Iowa but most of the shell is imported.

Keywords: Iowa, Mussels, Industry

WIEBE, A. H. 1928. Biological survey of the Upper Mississippi River, with special references to pollution. Bull. U.S. Bur. Fish. Bureau of Fisheries Document No. 1028, 43(1927):137-167. Washington, D.C.

Abstract: The aim of the biological survey was to determine whether the pollution from the Twin Cities is a factor in destroying aquatic life in the Upper Mississippi River; and if so, to ascertain, if possible, how far below these cities this pollution constitutes a problem or hazard

Keywords: Upper Mississippi River, Pollution, Survey

WIEBE, A. H. 1930. The Manganese Content of the Mississippi River water at Fairport, Iowa. Science. 71:248.

Abstract: Investigations were conducted on the manganese content of the Mississippi River near Fairport, Iowa, The results show that the quantity of manganese varies but is present all the time and therefore does not appear to limit the production of algae.

Keywords: Chemistry, Iowa

WIEBE, A. H. 1931. Dissolved Phosphorus and Inorganic Nitrogen in the Water of the Mississippi River. Science. 73:652.

Abstract: This author worked to determine what inorganic constituent of pond water may be the factor that limits plankton production and hence fish production. The results of studies indicate soluble phosphorus as the limiting factor.

Keywords: Chemistry

WILDS, S. D. 1972. Waterfowl Harvest on Keokuk Pool Mississippi River 1969 and 1970. Proc. Iowa Acad. Sci. 79(2): 79-84. M.S. Thesis, Iowa State Univ.

Abstract: The lower portion of Pool 19 (Keokuk) is an important resting spot for migrating ducks. A conflict arises over a dredging project at Ft. Madison. Conservationists believe it would hinder the fingernail clam population and therefore the duck food source. This study determines the species composition, chronology of hunters killing, and species selectivity by hunters.

Keywords: Pool 19, Waterfowl, Survey, Ducks, Harvest

WILLFAHRT, G. R. 1962. A growth analysis of the gizzard shad in the Upper Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 26 p.

Abstract: A summary of the computed mean lengths and weights of each collection is presented. Each collection is listed along with the date the collection was made, the age groups found within a collection, the number of fish in each age group, and the mean lengths and weights of that age group. A confidence interval of 95% is listed for each mean.

A summary of the data recorded on the habitat of the gizzard shad is included.

Keywords: Age and growth, Fish, Upper Mississippi River, Habitat, Gizzard shad

WILLIAMS, L. G. 1962. Plankton population dynamics. Public Health Pub. No. 663. Suppl. 2.

Abstract: A study which investigated the major phytoplankton communities of the river near East St. Louis, Burlington, Dubuque and St. Paul. Diatoms were the most prevalent organisms.

Keywords: Phytoplankton, Survey, Illinois, Iowa, Missouri, Minnesota

WILLIAMS, L. G. 1964. Possible relatonships between plankton-diatom species numbers and water quality estimates. Ecology. 45(4):809-823.

Abstract: Semimonthly samples from 103 scattered stations on the major rivers and Great Lakes of the United States reveal differences in kinds and numbers of dominating planktonic organisms. Diatoms dominate at these stations. A counting of 250 to 300 individuals per sample of diatoms using special hyrax mounts gives an adequate proportional representation of the four most abundant species of the population. Samples with high representation of individuals in the four most abundant species reliably indicate low species diversity, which in most situations is an indication of enrichment or eutrophication. Samples with high standing crops (productivity) usually show low species diversity. A study of the frequency of occurrence of the four most abundant species of diatoms and the six most abundant genera of algae demonstrated, with few exceptions, that the most frequent dominants have the highest standing crops. Dominating diatom species with highest frequency and composing 50% of the total abundance of diatoms for each of 2 years were calculated for each station, and the results indicate differences among the stations for studies of enrichment. An overall "trophic index" was computed by multiplying the percentage of the total abundance by the density level for each station. There is a correlation between the trophic index value and a range of stations known to be clean to heavily enriched. Eutrophic stations generally were represented by a few species composing a large portion of the diatom population, and the density level was usually high. "Clean" stations, on the other hand, had more species composing a small portion of the total live diatom population, and the overall density level was low. A parallel study of the most frequently occurring dominant algal genera showed the same trend.

Keywords: Water quality, Phytoplankton, Distribution, Population

WILLIAMS, L. G. 1966. Dominant plankt45ic rotifers of major waterways of the United States. Limnol. Oceanogr. 11: 83-91.

Abstract: Rotifers were the most numerous metazoans found in preserved plankton samples taken routinely at 128 sampling stations on the major rivers and Great Lakes of the United States. While rotifers of more than one genus often dominated a sample, the dominant form tended to be one species. Generally, stations with high population densities had low species diversity. Turbulence, silt, and some other edaphic factors appeared to be more important than industrial or domestic wastes, during winter and early spring, in reducing the number of

species of rotifers in the biota. During the summer and fall, differences in the abundances of dominant species appeared to be the best criterion for indicating differences in water quality or pollution.

Keywords: Zooplankton, Survey

WILLIAMS, L. G. 1972. Plankton diatom species biomasses and the quality of American rivers and the Great Lakes. Ecology. 53(6):1038-1050.

Abstract: Biomass (biovolume) measurements of the total phytoplankton per liter and the biomass of each species of diatoms in 5 microliters of diatom biomass per sample are presented for a number of sampling stations on the Great Lakes and several of the major rivers of the United States, comprising 54 semimonthly samples per station for 27 months. Diversity and dominance of species of diatoms for both the spring and fall population pulses are given for 128 stations. Possible relationships of various physical, chemical, and biotic parameters of water quality are suggested for immediate application to water pollution assessment and pollution abatement.

Keywords: Phytoplankton, Biomass

WILLIAMS, L. G. and C. SCOTT. 1962. Principal diatoms of major waterways of the United States. Limnol. Oceanogr. 7(3):365-379.

Abstract: Diatom populatons in semimonthly plankton samples collected from 73 stations of major waterways of the United States were analyzed by proportional counts to show percentage species composition of the 4 most abundant species per sample. The species are given for each station to show their relative abundance and percentage frequency of occurrence.

Keywords: Phytoplankton, Abundance, Distribution, Survey

WILLIS, Y. 1958. Upper Mississippi wildlife area. Mo. Conserv., October, 1958.

Abstract: A discussion of the waterfowl hunting areas with methods and tips to successfully duck hunt in the area.

Keywords: Wildlife, Refuges

WILSON, C. B. 1916. Copepod parasites of fresh-water fishes and their economic relations to mussel glochidia. Bull. U.S. Bur. Fish., 34(1914):331-374.

Abstract: An examination was made of the parasitic copepods which infest our fresh-water fishes in the Mississippi River and its tributaries and of the mussel glochidia which are also parasitic upon fish during their term of metamorphosis.

Keywords: Zooplankton, Parasites, Fish, Mussels

WILSON, C. B. and E. DANGLADE. 1914. The Mussel fauna of central and northern Minnesota. App. V to the report of the U.S. Commissioner of Fisheries for 1913. Separately issued as Bur. of Fish. Document No. 803.

Abstract: Determined the geographic distribution of the various mussels in those positons of the state. Made as careful a survey as possible of the various conditions, conducive or adverse to mussel development, in the different localities visited. Ascertain whether it would be profitable to introduce artificial propagation in any of the lakes or rivers, and if so, what species would be best adapted to the locality.

Keywords: Mussels, Minnesota, Distribution, Propagation, Habitat

WINKLEY, B. R. 1973. Metamorphosis of a river - A comparison of the Mississippi River before and after cutoffs. Water Resources Res. Inst. Miss. St. Univ.

Abstract: An alluvial river is a live entity and obeys the physical forces of nature. Any river, whether in a natural or a partially controlled state, will respond to the conditions imposed on it. This paper is written with just one object in mind; i.e., to document the hydraulic and geometric changes in the Vicksburg District portion of the river over the past 100 years, and particularly the period since the cutoffs. The data were obtained from the records of the Vicksburg District, Corps of Engineers, and from hydrographic survey maps dated 1880, 1912, 1948, 1962, and current surveys.

Keywords: History

WINKLEY, B. R., and P. C. HARRIS. 1973. Preliminary investigation of the effects of gravel mining in the Mississippi River. U.S. Army Corps of Engr. Vicksburg Dist., MS.

Abstract: This report presents available data initiating trends which could be at least partially attributed to the removal of the gravel armor coating from the bed of the Mississippi River in the Vicksburg District.

Keywords: Mining, Dredging

WOJCIK, E. F. 1969. Diurnal periodicity in the drift of Trichoptera larvae in Pool No. 6 of the Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 35 p.

Abstract: The purpose of this study was to determine some quantitative data concerning the drift of invertebrates in Pool 6 of the Mississippi and any diurnal periodicity which they might exhibit. Three sampling stations were established in the river. The first was on the Minnesota shore, the second across the main channel along an island, and the third in the outflow area of a backwater system. Samples were taken with nets fastened to a metal frame having an opening of approximately one square foot. The frames were supported just under the surface of the water on metal poles driven into the river bottom.

Keywords: Invertebrates, Pool 6, Movement, Behavior

WOJTALIK, T. A. and T. F. WATERS. 1970. Some effects of heated water on the drift of two species of stream invertebrates. Trans. Am. Fish. Soc., 99(4):782-788.

Abstract: Experiments were conducted on the effect of water temperature on the drift of the amphipod, Gammarus pseudolimnaeus Bousfield, and the stream mayfly, Baetis vagans McDunnough, using a water heater to produce various temperature regimes in exclosure channels in a natural stream. Under a constant temperature, the diel drift patterns of both species were unchanged relative to patterns exhibited under natural stream temperatures indicating that water temperature was not effective in determining the length of the period, the beginning and ending of high nocturnal drift, nor the general shape of the diel pattern. In experiments involving a constant differential from natural stream temperatures, B. vagans exhibited higher nocturnal drift with higher differentials, while the drift of G. pseudolimnaeus was

unaffected. Apparently water temperature affects the amplitude of drift within the diel periodicity for some species but not for others.

Keywords: Invertebrates, Thermal effluent, Movement, Behavior

WOOD, N. 1969. Invertebrate drift in the Mississippi River. M.S. Thesis, St. Mary's College, Winona, MN.

Abstract: This study was a preliminary identification of the organisms constituting the drift in the Mississippi River as a basis for future water pollution studies.

Keywords: Invertebrates, Survey, Identification

WRIGHT, K. L. 1969. Mississippi River Sport Fishing Creel Census in Pool 7, April 1, 1967-March 31, 1968. Wis. Dept. Nat. Res. Div. of Fish, Game and Enforcement. Bur. Fish. Manage., West Central Area. Management Rept. No. 26. 30 p.

Abstract: To determine the extent of usage of the Upper Mississippi River sport fishery and to obtain information about the anglers who fish those waters, a creel census was conducted in Pool 7 from April 1, 1967 to March 31, 1968. The 1967 creel census survey was conducted under the auspices of the Fish Technical Section of the Upper Mississippi River Conservation Committee as part of a plan to maintain a continuing evaluation of the sport fishery. Conservation agencies from the States of Wisconsin, Illinois, Iowa, Minnesota and Missouri conducted a coordinated sport fishery creel census as part of a plan to investigate the same pools once every five years. Pool 7 of the Mississippi River was censused by Wisconsin in 1962 and again in 1967.

Keywords: Fish, Pool 7, Creel census, Recreational boat traffic, Harvest, Pressure

WRIGHT, K. J. 1970a. Mississippi River special sport fishing creel census in Pool 7, March 1, 1967-April 30, 1967. Bur. Fish Manage., Wis. Dept. Nat. Res., Rept. No. 40.

Abstract: Creel census conducted from March-April 1967. 78% of the fishermen lived within 50 miles. Ice angling was most popular in March. In April boat fishing was most

popular. Bluegill, walleye, and sauger were most sought after fish.

Keywords: Creel census, Sport fishing, Pool 7, Ice, Harvest

WRIGHT, K. J. 1970b. The 1967-1968 sport fishery survey of the Upper Mississippi River. Publ. by UMRCC, Davenport, Iowa, 116 p.

Abstract: Catch rate for Pool 13 was the highest of all pools surveyed. A total catch per acre averaged 0.57 lb/acre/mo. while Pool 18, south of Pool 13, averaged a total catch of 0.90 lb/acre/mo.

Keywords: Fish, Creel census, Pools 4, 5, 7, 11, 13, 18, and 26, Harvest

WRIGHT, K. J. 1970c. Concentrations of Fishermen on the Mississippi River as Determined by Aerial Angler Counts Between 1963 and 1965 with comparisons to prior counts. Wis. Dept. Nat. Res., Div. Fish, Game and Enforcement, Bur. Fish Manage. Manage. Rept. No. 29. 5 p.

Abstract: To delineate concentrations of sport fishermen on the Mississippi River, aerial angler counts were conducted periodically from 1957 to 1965. This report summarizes the results of flights made from 1963 to 1965 and indicates the trends from 1957 to 1965. During these flights, all types of recreational activity on the river were recorded. In this way, heavily used portions of the Mississippi could be determined, and this knowledge could be applied to planning public access developments, future creel census studies, and determining general river usage by fishermen and others.

Keywords: Fish, Creel census, Recreational boat traffic, Wisconsin, Minnesota, Tailwater, Pools 3-12, Main channel, Backwater

WRIGHT, K. J. 1970d. Mississippi River special sport fishing creel census in Pool 7, March 1, 1968-April 30, 1968. Wis. Dept. of Nat. Res. Bur. Fish Manage. Manage. Rept. No. 39.

Abstract: A creel census was conducted in Pool 7 from March 1 to April 30, 1968, to determine the extent of usage of the

Upper Mississippi River sport fishery and to evaluate the fishing pressure and success during a two month period previously closed to fishing for large game fish. The 1968 special creel census survey was conducted under the auspices of the Fish Technical Section of the Upper Mississippi River Conservation Committee as part of a plan to maintain a continuing evaluation of the sport fishery.

Keywords: Sport fishing, Creel census, Pool 7, Harvest

WRIGHT, K. J. 1971a. Mississippi River Special Tailwater Sport Fishing Creel Census in Pool 7, March 1, 1969-April 30, 1969. Wis. Dept. Nat. Res., West Central Div., Fish Manage. Rept. No. 45.

Abstract: A creel census was conducted in the tailwaters of Pool 7 from March 1 to April 30, 1969, to evaluate the fishing pressure and harvest during a two month period previously closed to fishing for large game fish. The 1969 special tailwater creel census survey was conducted under the auspices of the Fish Technical Section of the Upper Mississippi River Conservation Committee as part of a plan to maintain a continuing evaluation of the sport fishery.

Keywords: Tailwater, Sport fishing, Pool 7, Creel census

WRIGHT, K. J. 1971b. Mississippi River special tailwater sport fishing creel census in Pool 7, March 1, 1970-April 30, 1970. Wis. Dept. of Natural Res., Bur. Fish Manage. Rept. No. 46.

Abstract: A creel census was conducted in the tailwaters of Pool 7 from March 1 to April 30, 1970 to evaluate the fishing pressure and harvest during a two month period previously closed to fishing for large game fish. The 1970 special tailwater creel census survey was conducted under the auspices of the Fish Technical Section of the Upper Mississippi River Conservation committee as part of a plan to maintain a continuing evaluation of the sport fishery.

Keywords: Tailwater, Creel census, Sport Fishing, Pool 7, Pressure, Harvest

WRIGHT, K. J. 1972. Mississippi River special tailwater sport fishing creel census in Pool 7, March 1-April 30, 1972. Wis. Dept. Nat. Res. Bur. Fish. Manage. West Central Div. Manage. Rept. No. 56.

Abstract: A creel census was conducted in the tailwaters of Pool 7 from March 1 to April 30, 1972 to evaluate the fishing pressure and harvest during a two month period previously closed to fishing for large game fish. The 1972 special tailwater creel census survey was conducted under the auspices of the Fish Technical Section of the Upper Mississippi River Committee as part of a plan to maintain a continuing evaluation of the sport fishery.

Keywords: Tailwater, Sport fishing, Pool 7, Creel census, Pressure, Harvest

WRIGHT, K. J. 1973. An assessment of fish abundance, habitat and fishing in a portion of Pool 8, Mississippi River, subject to highway intrusion. Wis. Dept. Nat. Res. Bur. Fish. Manage. West Central Div. Manage. Rept. No. 63.

Abstract: It became apparent in 1969 that a proposed La Crosse Freeway could involve major alterations of Mississippi River fisheries habitat in the La Crosse Area. Discussions and meetings with La Crosse based Wisconsin Division of Highways personnel revealed that two of three alternate routes proposed for the south end of the freeway would pass through approximately four miles of Pool 8 of the Mississippi River including biologically productive fisheries and wildlife refuge land.

Keywords: Fish, Abundance, Habitat, Pool 8, Fishing, Refuges

WYNES, D. 1976. Age growth and food habitats of the Centrachidae in Pool 8 of the Upper Mississippi River. M.S. Thesis, Univ. Wis., La Crosse.

Abstract: Nine species of centrarchids were collected during the summer of 1975 from Pool 8 of the Upper Mississippi River. The purpose of the study was to gather age, growth, and food habit data on these Pool 8 populations.

All age and growth calculations were made using total length measurements. Age and growth data included mean length at capture, backcalculated lengths at time of annulus formation, length frequency of fish collected, length-weight regression, condition factors (K), and

young-of-the-year growth rates. Only length at capture and age was reported on the warmouth since only one specimen was collected. Food habit analysis was based on frequency of occurrence, percent of total number, and percent of total volume. No food analysis was done on the warmouth.

Keywords: Age and growth, Food habits, Pool 8, Fish

ZAWORSKI, S. S. 1970. Winter-spring infestation rates of the acanthocephala Leptorhynchoides thecatus in three species of fish in Pool No. 6 of the Mississippi River. B.A. Thesis, St. Mary's College, Winona, MN. 44 p.

Abstract: The purpose of this study was to examine three species of fish -- Bluegills, Lepomis machochirus, Black Crappies, Pomoxis nigro--maculatus, and Yellow Perch, Perca flavescens -- for infestation of the Acanthocephalan, Leptorhynchoides thecatus, during the winter and the spring seasons of 1970 in Pool Six of the Upper Mississippi River. There were 269 fish obtained using an electroshocking device and they were examined for infestation. The rates and degrees of infestation were variable for the three species of fish. Also examined were the affects that Leptorhynchoides thecatus had on the age, the sex, and the coefficient of condition of the different species of fish.

Keywords: Pool 6, Fish, Parasites

ZEIS, SR. L. 1970. An estimate of the production rate of Fragilaria capucina from mud and sand substrates at varying depths within a slough of the Upper Mississippi River, Pool No. 6. M.S. Thesis., St. Mary's College, Winona, MN.

ABSTRACT: An improved benthos emergent sampler was used in procuring samples of phytoplankton for quantitative evaluation of production of Fragilaria capucina in the sloughs in the Upper Mississippi River Pool 6 near Homer, Minnesota. The McNabb membrane filter technique was used in quantitative analysis. Relevant data concerning the real and potential role of the sloughs in river ecology, were obtained.

Keywords: Slough, Pool 6, Production, Phytoplankton, Methods

ZIEGLER, S. R. 1976. Fluoristic analysis and vascular plant succession of dredge material in Navigational pool no. 8 on the Upper Mississippi River with respect to age and education. M.S. Thesis., Univ. Wisc. La Crosse, WI

Abstract: A preliminary survey of dredged-material vegetation was conducted in summer 1974 (10 sites). During 1975 23 sites were surveyed almost all three times in order to get spring, summer, and fall types. During the

two growing seasons a total of 3000 specimens were made consisting of 304 species from 64 families. The largest ones were Cyperaceceae (5 genera and 29 species) Gramineae (25 genera and 48 species), and Compositae (20 genera and 42 species), Two grasses: Sporobolus cryptandius and Triplasis purpurea were collected. A sedge, Cyperus schweinitzii, and a tumbleweed, Cyclolema atriplicifolium were the pioneer herbaceous species of the dry, exposed dredged-material sites. Woody species do not occur readily. Eventually vines and shrubs establish themselves. Vitis riparia (riverbank grape), Toxicadendron rydbergii (poison ivy), and Rubus occidentalis (black raspberry) eventually encroach on these exposed areas from the surrounding alluvial forests.

Keywords: Vegetation, Dredging, Pool 8, Age and growth, Succession, Spoil

ZIEGLER, S. R. and S. H. SOHMER. 1977. The Flora of Dredged Material Sites in Navigation Pool 8 of the Upper Mississippi River. Technical Report D-77-31. Environmental Effects Laboratory, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 97 p.

Abstract: A survey of vegetation growing on dredged material in Navigation Pool 8 of the Upper Mississippi River was made to determine plant species. Twenty-three dredged material sites in Pool 8 were surveyed and more than 3000 specimens collected of 304 species representing 64 plant families. Correlation of site ages, elevations, and plant community associations was used to determine primary colonizers of the various dredged material habitats.

Sporobolus cryptandius (Torr.) Gray, Triplasis purpurea (Walt) Chapm., Cyperus schweinitzii Torr., and Cycloloma atriplicifolium (Spreng.) Coult. were found to be pioneer herbaceous species of dry exposed dredged material sites. Upland invasion by woody species did not occus readily, but after a lengthy period species such as Vitis riparia Michx., Toxicodendron rydbergii Greene, and Rubus occidentalis L. encroached from surrounding forests.

Keywords: Dredging, Pool 8, Upper Mississippi River, Vegetation, Habitat, Spoil, Succession

ZIMMER, D. W. 1976. Observations of invertebrate drift in the

Skunk River, Iowa. Proc. Ia. Acad. Sci. 82(3-4):175-178.

Abstract: Invertebrate drift was collected weekly from four sites on the Skunk River in the summer of 1971. Drift was composed primarily of lotic insects. The composition and abundance of drift was related to predominant substrate types and water quality. There was a significant negative correlation between drift density and discharge at sites with sand bottom sediments, but drift density was not related to discharge at sampling areas with gravel and rubble substances.

Keywords: Invertebrates, Skunk River, Iowa, Sediment, Movement, Behavior

ZIMMERMANN, H. J. 1977. Season events in the invertebrate drift in the Mississippi River near Becker, Minnesota. M.S. Thesis, St. Cloud State Univ. St. Cloud, MN. 80 p.

Abstract: Invertebrate drift was collected from the upper Mississippi River at approximately 30-day intervals during the ice-free months from July, 1975, through June, 1976. Samples were collected at five stations located along a horizontal transect, with deep water sampling gear used at three of the five stations. Quantitative analysis of the samples made possible the determination of the seasonal fluctuations in the taxonomic composition, diel periodicity, and horizontal and vertical distribution of the invertebrate drift.

Aquatic insects of the orders Trichoptera (30%), Ephemeroptera (28%), and Diptera (33%) dominated the drift in all months except April, when Plecoptera comprised 24% of the total number. Variations in relative abundance of the three major orders were observed both between sampling periods and within sampling periods, between stations. A nocturnal increase in the drift was most pronounced in the spring and early summer, and reduced in autumn. Between sampling stations, the nocturnal increase was least pronounced in the mainstream, especially near the bottom. Drift densities varied across the river and appeared to be dependent upon current velocity and water depth. The relative amount taken at each station varied between sampling periods and appeared to be dependent upon river discharge.

Keywords: Invertebrates, Survey, Movement, Behavior, Abundance

ZON, R. 1927. Taming the father of waters. Jour. For. 25.

Abstract: This paper blames the backwardness of China on its recurrent flods. Since the U.S is the richest country in the world, it should be able to control the Mississippi River floods. Army Engineers have put their sole trust in the series of now continuous levees down the banks of the river to the Gulf of Mexico. Control forests on the upper watersheds tributary would lessen flood effects.

Keywords: Flooding

AGENCIES

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ABLE GROUP I. 1971. A nine week survey of the Eastern waters of the Mississippi River at Mile 424.5. Biol. 317.

Abstract: Testing included O_2, CO_2, pH, turbidity, alkalinity, temperature, and settleable matter. Fish and turtles were collected with hoop nets and traps. Their lengths and weights were recorded, and correlations were made between biological, chemical and physical parameters.

Keywords: Survey, Turbidity, Fish, Reptiles, Temperature, Pool 18

ANONYMOUS. 1879. The history of Muscatine County, Iowa. W. Hist. Co., Chicago.

Abstract: This history describes the Mississippi Valley itself and traces its story from before the Lousiana Purchase to its importance in the life of Muscatine county in the late 1800's.

Keywords: Iowa, History

ANONYMOUS. 1953-1956. Mississippi River commercial fishing statistics. Ann. Rept. Wis. Cons. Dept. unpub. mimeo.

Abstract: Commercial fishing statistics were collected to report pools fished, kinds of gear used, the amount and species of fish taken and other pertinent information. Carp comprised the majority of the total catch.

Keywords: Commercial fishing, Equipment, Fish

ANONYMOUS. 1959a. Walleye studies on the Mississippi. Iowa Conservationist, 18(7).

Abstract: An electroshocking survey to determine the traveling habits and the life history of large-river pike. Tagging was conducted and length, maturity and sex of the fish were taken.

Keywords: Fish, Survey, Walleye

ANONYMOUS. 1959b. Walleye studies on the Mississippi. Reprinted from The Dubuque Herald. Ia. Conserv. 18(7):151-152.

Abstract: Electroshocking was done on the Mississippi in an attempt to amass information on the traveling habits and

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the life history of large river pike. This is the final tagging operation of a three-year walleye and sauger project which began in April 1957.

Keywords: Walleye, Life history

ANONYMOUS. 1970. Annual report, Mississippi River commercial fishing statistics. Bur. Fish Mgmt. Rept., Wis. Dept. Nat. Res. unpubl. mimeo.

Abstract: Characteristics of both the angler and the catch were recorded. For all areas studied, the species most often sought were walleye, sauger, channel catfish, bluegill and crappie. Boat fishing accounted for most of the total fishing hours. Bank, barge, and ice fishing made up the remainder.

Keywords: Commercial fishing, Fish

ANONYMOUS. 1971. Patience Pays Off. Ill. Wildlife 7(4):4.

Abstract: A 15-year campaign by two northwestern Illinois conservation officers to clean up a flagrant source of Mississippi river oil pollution finally ended in victory with assessment of $1,000 damages and a permanent injunction against the Milwaukee Railroad at Savanna.

Keywords: Pollution, Petroleum

ANONYMOUS. 1972a. Walton League Opposes Dredge and Fill Projects on Upper Mississippi River. Outdoor America 37(1):9.

Abstract: The Corps proposes to dredge a commercial harbor at Fort Madison and to develop a 12-foot navigation channel in the Upper Mississippi River. The Izaak Walton League opposes this because of the extremely serious environmental problems involved.

This project, coupled with the dredging and spoil disposal necessary to build the Fort Madison commercial access channel would undoubtedly destroy a large area of fish and wildlife habitat in the Keokuk pool.

Keywords: Dredging, Disease

ANONYMOUS. 1972b. St. Louis cleans up the Mississippi. Civil Engineering, 42(5):61-63.

Abstract: None of the largest water-pollution abatement projects ever undertaken in the U.S., St. Louis has curbed the flow of more than 300 million gal/day (13.1m^3/s) of raw sewage into the Mississippi. The project, containing a huge interceptor and two big primary-treatment plants, has some innovations that should interest civil engineers. This pollution-abatement system is a nominee for the Outstanding Civil Engineering Achievement Award of 1972.

Keywords: Water quality, Missouri, Urbanization, Pollution

ANONYMOUS. 1974. Safe Drinking Water Has Become a Federal Case. Chemical Week, 115(22):46-48.

Abstract: The furor over the discovery of alleged carcinogens in drinking water taken from the Mississippi River is providing the impetus for federal standards. Backers of the Safe Drinking Water Act are confident that legislative action will succeed. The oil industry is among objectors to the bill because underground injection would be prohibited. AWWA supports a federal bill, but opposes national standards. Impacts of a safe drinking bill on water treatment, on the chemical industry, and on environmental protection are discussed.

Keywords: Pollution, Water quality

ANONYMOUS. 1975. 1974's Legislation: Mixed Results. Env. Action, 6(17):3-7.

Abstract: The environmentally-oriented legislation of 1974 is discussed. Congress approved three valuable pieces of wilderness legislation, protecting 16 areas east of the Mississippi, setting aside a total of nearly .5 million acres of wilderness throughout the country, and directing an investigation of 29 rivers for possible inclusion in the wild and scenic rivers system. Legislation was enacted to fund and manage non-nuclear energy research. An act establishing the Cuyahoga Nat'l Recreation Area near Akron, Ohio, was passed, and a unique area of Texas was saved from development by passage of another preservation act. Although a relatively modest stripmining control bill was vetoed at the end of 1974, observers feel that an even stronger stripmining control bill will be passed in 1975.

Keywords: Recreation, Survey, Habitat management, Legislation, Wilderness

ANONYMOUS. 1977. The great western drought of 1977. Time, 109(10): 76-82.

Abstract: Besides the worst dust storm in 20 years, threatened crop failures, hydroelectric power shortages, considerable economic damage, and growing anxiety over summer and fall water allocations, continuation of the western U. S. drought has ominous implications that stretch far beyond the Mississippi River. It questions how the U. S. should use its available water, how much population growth this resource can sustain, and whether the U.S. can continue easing world hunger pangs. Rising domestic food prices, job layoffs, and increased inflation are almost certain to follow. The already grim picture is further blackened by a warning from some climatologists that current dry conditions are threateningly similar to those that preceded the drought and famine spell of the depression era.

Keywords: Hydrology, Climatology

ANONYMOUS. 1978. Fifteen years of fish collections data sheets. Museum of Natural History Files. Univ. of Wisc., Stevens Point, Wisconsin.

Abstract: Undergraduate fish research on the Mississippi River and other bodies of water. This is a compilation of student work from 1963 on, done mainly by undergraduate students and is unpublished data.

Keywords: Fish, Survey, Research

ARINC RESEARCH CORP. 1974. Inland Waterways Communications Study. Volume I. Executive Summary. Volume II. Study Report. Annapolis, MD. 20 p.

Abstract: This report presents the results of a study of the communications requirements of the companies operating on the inland waterways, encompassing the Mississippi, Illinois, Ohio, Tennessee, Warrior and Missouri rivers and a portion of the Inter-coastal Waterway. Industry communications requirements are presented in detail,

leading to the development of several alternative system concepts for an integrated Inland Waterways Communications System. A detailed evaluation of the hypothesized alternatives is presented and the preferred system concept is recommended. The implementation characteristics of the preferred system concept are described, as are the type of organization required to operate the system and the regulatory environment in which the system will operate.

Keywords: Survey, Illinois River, Missouri River

BAKER GROUP. 1970. Ecology Final Report. Biol. 317.

Abstract: A study group which tested O_2, CO_2, pH, turbidity, alkalinity, temperature, and settleable matter in the Mississippi River. Fish and turtle surveys were taken.

Keywords: Survey, Pool 18

BAKER GROUP. 1971. A nine week ecological survey of the Mississippi River and backwater chute. Biol. 317.

Abstract: A survey of biological and chemical parameters of the Mississippi River at mile 424.5, conducted by university students.

Keywords: Ecology, Survey, Chute, Pool 18

BAKER GROUP. 1972. An eight week ecological survey of the fish populations of the Mississippi River at Mile 424.5.

Abstract: A survey by university students to monitor fish populations in the Mississippi, determining species present and their distribution.

Keywords: Fish, Ecology, Survey, Population, Pool 18

BI-STATE DEVELOPMENT AGENCY. 1954. Mississippi River Water Pollution Investigation. St. Louis Metropolitan Area. 378 p.

Abstract: The survey carried on during the period 1951-52, covers the stretch of river between Alton Dam and Jefferson Barracks Bridge and includes the collection of river water samples for physical, chemical, and bacteriological examination; studies pertaining to the biological

life in the stream; study of hydrometric data; determination of the sources and magnitude of the pollution loading from the area; and the collection of data relative to uses of the water resources.

Keywords: Pollution, Water quality, Survey, Missouri

BUREAU OF MINES. 1976. Projects to Expand Fuel Sources in Eastern States. Survey of Planned or Proposed Coal Mines, Coal and Noncoal, Conversion Plants, Electric Generating Plants, Oil Refineries, Uranium Enrichment Facilities, and Related Infrstructure, in State East of the Mississippi River (as of June 1976). 121 p.

Abstract: This report comprises tables listing the name, location, and other pertinent data concerning future fuel related projects. The tables include information on projects involving the proposed or planned development of storage, transportation, and conversion facilities; the report covers the 26 states east of the Mississippi River. Of the total 592 projects for which information is provided, 492 concern coal mines and electric generating plants.

Keywords: Survey, Power

BUREAU OF OUTDOOR RECREATION. 1970. Upper Mississippi River Commission Basin Study. Recreation (Appendix K) 126 p.

Abstract: A discussion of the recreational facilities which are available on the Upper Mississippi River. Included are parks, camping facilities, boating, and fishing.

Keywords: Upper Mississippi River, Survey, Recreation

BUREAU OF SPORT FISHERIES AND WILDLIFE. 1972. Proposed Fish Control Laboratory, LaCrosse, Wisconsin. Washington, D. C. 251 p.

Abstract: The project concerns relocation of a fish control laboratory, engaged in research on controls for such species as as carp and sea lamprey, on French Island in Campbell, Wisconsin. Expected effects are economically and culturally favorable in general. Some exotic plant and animal life may escape to the river water.

Keywords: Wisconsin, Fish, Fish management, Limnology

CHARLES RIVER ASSOCIATES, INC. 1970. A Study of the Inland Waterway Use Charge Program. Cambridge, Mass. 82 p.

Abstract: The purpose of the study is to examine the economic implications of a number of proposed user charge methods. First the criteria are presented by which user charge methods should be evaluated. These criteria include economic efficiency, equity, and administrative simplicity. Then a number of alternative user charge mechanisms are examined and appraised inlight of these criteria. In addition, estimates are made of the rates necessary under each user charge method to recover current annual operating and maintenance costs as well as investment costs. An attempt is also made to appraise the diversion of traffic that might occur on the different waterways if these charges were imposed. This study is confined to shallow draft, inland waterway transport. Port operations, deep channels connecting ports to the sea, deep draft coastal shipping, and Great Lakes shipping are excluded. While the theory of user charges is general, evaluation of impact is confined to shallow draft operations, principally on the Mississippii and its tributaries.

Keywords: Survey, Barges, Commercial boat traffic

CHARLIE GROUP. 1973. An eight week ecological survey of an aquatic community. Biol. 317.

Abstract: Aquatic studies were conducted in the Mississippi River near river mile 424.5 to assess the aquatic community.

Keywords: Ecology, Survey, Pool 8

CHARLIE GROUP. 1974. A seven week ecological survey of the Mississippi River at mile 424.5. Biol. 317.

Abstract: A seven week ecological survey of the Mississippi River in Pool 18, including the channel and backwater area at mile 424.5 was conducted from March 27, 1974 to May 8, 1974. This study was undertaken to evaluate the chemical and physical factors in relations to long term implications of biota of the river habitat. The chemical factors that were tested included Dissolved Oxygen, Carbon Dioxide, Oxygen Demand Index (ODI), Ortho and Meta Phosphate, pH, Nitrogen Nitrate, and Nitrogen Nitrite. The physical factors included turbidity (Initial and Residual), Settleable Matter, Wind Velocity, Water Flow, Air Temperature, Solar Radiation and Precipitation.

Keywords: Ecology, Survey, Pool 18, Water quality, Main channel, Backwater

CHEECHI AND CO. 1964. A pre-feasibility study of small-boat harbor projects for the city of Grafton, Jersey County, Illinois. Prepared in cooperation with Area Redevelopment Administration, Washington, D.C. 56 p.

Abstract: Grafton has locational advantages which would favor the long-range outlook for a marina operation. There is an impressive accumulation of firm information indicating that the demand for first-class boating facilities would justify a relatively large harbor and service complex (marina) at Grafton. Such a marina at Grafton would bring many direct and indirect benefits to the community. In order to pay off, a small-boat harbor at Grafton would have to generate revenues from a range of services normally carried by successful marina. It would also require professional development and management from the outset. Since the City of Grafton is hoping to undertake a major investment project with very limited financial resources, it must rely heavily on outside assistance. This could come from private, State, and Federal sources. Any of the projects analyzed in this report would be financially feasible if certain basic fixed capital cost items coule be financed by grants-in-aid. However, only the smaller project would have a chance to payoff if no grants were available.

Keywords: Commercial boat traffic, Recreational boat traffic, Recreation, Illinois, Development

COMMONWEALTH EDISON COMPANY. 1972. Quad-Cities Station, Units 1 and 2. Determination of Thermal Effects in the Mississippi River. Chicago, Ill. 776 p.

Abstract: The results of thermal monitoring near the Quad-Cities Station are reported in this report.

Keywords: Thermal effluent, Water quality, Nuclear power

COMMONWEALTH EDISON COMPANY. 1973. Quad-Cities Station, Units 1 and 2. Hypochlorination Test Program. Chicago, Ill. 33 p.

Abstract: The effects of low chlorination level testing near the Quad-Cities Station are reported.

Keywords: Water quality, Nuclear power

COMMONWEALTH EDISON COMPANY. 1974. Quad-Cities Station, Units 1 and 2 Semiannual Report on Radioactive Waste and Environmental Monitoring, July 1, 1973 - December 31, 1973. Chicago, Ill. 65 p.

Abstract: Data on the effects of radioactive wastes on the environment near the Quad-Cities Station are reported.

Keywords: Survey, Water quality, Nuclear power

COMMONWEALTH EDISON COMPANY. 1975. Three-Sixteen (a&b) Demonstration, Quad-Cities Nuclear Station, Mississippi River. Chicago, Illinois.

Abstract: The result of thermal monitoring of the Mississippi River near the Quad-Cities Station are discussed in this report.

Keywords: Survey, Thermal effluent, Nuclear power, Ecology, Limnology

DIRECTORATE OF LICENSING (AEC). 1973. Proposed Issuance of an Operating License for the Prairie Island Nuclear Generating Plant by the Northern States Power Company, Docket Nos. 50282, 50-306. Washington, D. C. 294 p.

Abstract: The proposed actions are the issuance of operating licenses to the Northern States Power Company for the Prairie Island Nuclear Generating Plant located within the Burnside Township, Goodhue County, Minnesota (Docket Nos. 50-282 and 50-306). The Plant has two Pressurized-Water Reactors, each of which produces 1650 megawatts of heat and has a gross electrical output of 560 megawatts. The condenser is cooled by a flexible system, used in a closed-cycle mode except when precluded by weather conditions. In that mode, cooling water is withdrawn from the Mississippi River at the rate of 185,000 gallons per minute. A summary of environmental impacts and resulting beneficial and adverse effects is given.

Keywords: Minnesota, Nuclear power, Survey, Water quality

EAST-WEST GATEWAY COORDINATING COUNCIL. 1976a. Port of Metropolitan Saint Louis Atlas. St. Louis, Mo. Maritime Administration, Washington, D. C. 107 p. and Appendices A-C.

Abstract: The report depicts the 105 port facilities, by dock type, ownership and location in the Metropolitan St. Louis area. Also illustrated on the maps are major highways, railroads, shipyards, fleeting areas, river and streams, levees, floodwalls and the estimated areas that are occasionally flooded.

Keywords: Missouri, Flooding, Barges, Commercial boat traffic, Dike, Survey

EAST-WEST GATEWAY COORDINATING COUNCIL. 1976b. Study of the Port of Metropolitan St. Louis Phase II-A. A Primer on Inland Waterways Ports. St. Louis, Mo. Kearney Inc., Chicago, Ill. Maritime Administration, Washington, D.C. 208 p.

Abstract: The report presents the results of a study of inland marine port operations. It was performed for the United States Maritime Administration through the East-West Gateway for the Metropolitan St. Louis Area. This text provides a reasonably comprehensive overview of an inland waterways port and should serve as a primer on the subject. Although the official purpose of the study was to identify water flow and other factors which affect inland port operations, the study provides the first reasonably thorough analysis of an inland waterways port as a part of the nation's transportation system.

Keywords: Missouri, Flooding, Barges, Commercial boat traffic, Dike, Survey

ECOLOGY CONSULTANTS, INC. 1974 - 1976. Quarterly reports. Carroll County Station. Terrestrial monitoring program. Prepared for Commonwealth Edison Co.

Abstract: The effects of Station construction of the Carroll County Station on the terrestrial environment are discussed.

Keywords: Survey, Vegetation, Ecology

ECOLOGY CONSULTANTS, INC. 1977. Sylvan slough mussel study for new Moline bridge at Rock Island Arsenal, Illinois. Rept. to U.S. Army Corps of Eng., Omaha Dist. 12 pp.

Abstract: In response to a solicitation from the United States Army Corps of Engineers, a mussel study was conducted at a proposed bridge site in the Mississippi River to provide pre-construction baseline data.

The proposed stucture would replace the existing arsenal bridge across Sylvan Slough joining Arsenal Island with Moline, Illinois at approximate river mile 485.5 in Pool 15.

Objectives of the study were to:

1. Provide an inventory of the mussel species in Sylvan Slough in the immediate vicinity of the proposed bridge site.
2. Provide estimates of relative abundance of those species identified.
3. Delineate the extent of the mussel bed and its commercial value.

Keywords: Mussels, Slough, Illinois

FEDERAL HIGHWAY ADMINISTRATION. 1971. Crawford County, USH 18, Mississippi River Crossing, City of Prairie du Chien. Madison, Wis. Wisconsin Div. 95 p.

Abstract: The report concerns a proposed new crossing of Highways 18 and 60 over the Mississippi River between Marquette, Iowa and Prairie du Chien, Wisconsin. The area is rich in historical significance, abundant with recreational opportunities, wildlife resources, and scenic beauty.

River bottom is within the Upper Mississippi River Wildlife and Fish Refuge. No increase in noise, or air and water pollution is expected. Public safety and fire protection will be improved. Neighborhood character along Wisconsin and Iowa Streets will be changed; however, this effect is in accord with local planning.

Keywords: Survey, Wisconsin, Wildlife, Upper Mississippi River Wildlife and Fish Refuge, Water quality

FEDERAL HIGHWAY ADMINISTRATION. 1972. FA Route 402, From the East Bank of the Mississippi River Near Fulton, Illinois in Whiteside County, East and Southeasterly for Approximately 18 Miles to the Intersection of Proposed FA Route 403 and Township Road 224 in Whiteside County, Mississippi. Springfield, Ill. Illinois Div. 107 p.

Abstract: The report describes a study of the alternate corridors to contain a four-lane, fully access controlled freeway from the east bank of the Mississippi River near Fulton, Illinois, to FA Route 403 near Como, Illinois, a distance of approximately 18 miles. Three corridors were originally studied; however, it was found that the development of Corridor B would, near the terminal point by Sterling, Illinois, lead to a duplication of services to be provided by FA Route 403, which is currently under construction. As a result of this duplication, it is felt that Corridor B is unfeasible for development. The two remaining corridors, Corridor A and Corridor A sub 1, are basically the same differing only in how they bypass Morrison. Corridor A provides a southern bypass of Morrison while Corridor sub 1 provides for a northern bypass. A brief summary of adverse and beneficial environmental effects is included.

Keywords: Illinois, Survey, Pollution, Wildlife

FEDERAL SECURITY AGENCY. 1951. Upper Mississippi Drainage basin: a co-operative state-federal report of water pollution. Pub. Health Serv. Water Poll. Ser. No. 15. 81 pp.

Abstract: This summary report presents information about the ways our water resources are used, the pollution going into our water resources and the resulting damages, the benefits which may result from the pollution prevention measures now in effect, and those required.

Keywords: Pollution, Water quality

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. 1964, 1967, 1968, 1969. Proceedings of the conference in the matter of pollution of the interstate and intrastate waters of the Upper Mississippi River and its tributaries - Minnesota - Wisconsin.

Abstract: The purpose of these conferences is to bring together representatives of the State water pollution control agencies, and other interested parties, to review the existing situation, the progress which has been made, to lay a basis for future action, and to take remedial action.

Keywords: Pollution, Water quality, Wisconsin, Minnesota

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. 1966. Pollution of the Upper Mississippi River and Major Tributaries. Chicago, Ill. Great Lakes Region. 525 p.

Abstract: This report determines the extent of pollution in the rivers of the study area. The study area extends on the Mississippi River for 107 miles between its confluences with the Rum and Chippewa rivers, on the Minnesota River from its mouth upstream 110 miles to Mankato, Minnesota, and on the St. Croix River from its mouth 55 miles upstream to Taylors Falls, Minnesota. It also investigates the principal sources of pollution and contributions from these sources, determines the effect of pollution on the numerous water uses, and develops programs for the achievement of various water uses on rivers of the study area.

Keywords: Pollution, Water quality, Upper Mississippi River, Minnesota

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. 1967. Pollution of the Interstate and Intrastate Waters of the Upper Mississippi River and Its tributaries - Minnesota and Wisconsin. Proceedings of Conference, Session (2nd), Held at Minneapolis, Minnesota, on February 28, March 1 and 20, 1967. Volumes 1-3. Washington, D.C. 336 p.

Abstract: The report is on the second session of the conference on pollution of the interstate and intrastate waters of the Upper Mississippi River and its tributaries in the states ofWisconsin and Minnesota, held in 1967, at Minneapolis, Minnesota.

Keywords: Pollution, Upper Mississippi River, Minnesota, Wisconsin, Water quality

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. 1968. Pollution of the Upper Mississippi River and its Tributaries - (Minnesota-Wisconsin). Proceedings of Progress Evaluation Meeting of Conference Held in Minneapolis, Minnesota on April 30, 1968. Washington D. C. 382 p.

Abstract: The report is on the progress meeting of the conference concerning pollution of the interstate and intrastate waters of the Upper Mississippi River and its tributaries (Wisconsin-Minnesota) for 1968. It includes statements, discussions, and recommendations on: Municipal and industrial pollution control; St. Croix River; method of handling overflow from lakes; and related information.

Keywords: Minnesota, Wisconsin, Water quality, Pollution, Upper Mississippi River

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. 1969a. Mississippi River Reconnaissance, Report of Sampling in the Vicinity of Dubuque, Iowa, and the Tributaries from Above Dubuque to Below Keokuk, Iowa, in both Iowa and Illinois. Chicago, Ill. Lake Michigan Basin Office. 169 p.

Abstract: The results of a reconnaissance run of the Mississippi River in the Iowa area to determine the effect that poorly treated or untreated wastes, especially sewage, has on the Mississippi is presented. Biological and chemical oxygen demand samples were collected for analysis from 55 sampling points along the Mississippi River tributaries in the vicinity of Dubuque, Iowa. Field measurements and observations along with physical observations and measurements were recorded. Potential sources of pollution were observed and recorded, and the sampling areas were photographed. The Mississippi shore line was inspected for industrial and domestic waste outfalls. Bottom samples were collected at various points.

Keywords: Iowa, Illinois, Pollution, Water quality, Phytoplankton, Benthos, Survey

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. 1969b. Conference to Consider the Iowa Water Quality Standards for the Mississippi River Basin Interstate Waters - State of Iowa. Held at Davenport, Iowa on 8-9 April 1969. Washington, D. C. 668 p.

Abstract: The report contains the minutes, discussions, and papers presented relative to a conference held in Iowa to establish water quality standards for interstate waters.

Keywords: Iowa, Pollution, Water quality

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. 1969c. Proceedings of Second Session of the Conference to Consider the Establishment of Water Quality Standards for the Missouri River Basin Interstate Waters. State of Iowa Held in Council Bluffs, Iowa, on 15-16 April 1969. Washington, D. C. 766 p.

Abstract: The conference considers the establishment of water quality standards for the waters of the Mississippi River, Missouri River, and designated tributaries of these waters subject to the jurisdiction of Iowa which are considered interstate waters under the Federal act.

Keywords: Water quality, Iowa, Pollution, Missouri River

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. 1969d. Progress Evaluation Meeting (2nd) in the Matter of the Interstate and Intrastate Waters of the Upper Mississippi River and Its Tributaries - States of Wisconsin and Minnesota. Held at Minneapolis, Minnesota on 22 July 1969. Washington, D. C. 362 p.

Abstract: The report is on a conference on water pollution for the interstate and intrastate waters of the Upper Mississippi River and its tributaries in the states of Minnesota and Wisconsin held in 1964. Included in the report are discussions, statements and recommendations on: Federal installations; surface water discharges; water standards for Minnesota; automatic monitoring program; and related subjects.

Keywords: Wisconsin, Minnesota, Pollution, Water quality

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. 1970. Clean Water for Mid-America. Chicago, Ill. Public Information Office. 32 p.

Abstract: The booklet is the story of what the Federal government and others are doing to make 'Clean Water' for Mid-America a reality. It is about the major fresh waters of Mid-America, the Great Lakes and the Upper Mississippi River.

Keywords: Water quality, Pollution, Upper Mississippi River

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. 1974a. Summary and Pollution Abatement Recommendations for the Upper Mississippi River and Major Tributaries. St. Paul, Minn. Twin CitiesUpper Mississippi River Project. 60 p.

Abstract: The investigation of water pollution along the Upper Mississippi River and its major tributaries is reported. The investigation was conducted to gather information on water quality, sources and quantities of wastes, the extent of pollution, and necessary abatement measures in the following river reaches: Upper Mississippi River from the Rum River at Anoka, 107 miles downstream to the outlet of Lake Pepin; lower 110 miles of the Minnesota River; and the lower 52 miles of the St. Croix River.

Keywords: Pollution, Water quality, Upper Mississippi River, Minnesota

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION. 1974b. Water Quality Standards Conference, State of Iowa. Iowa Interstate Waters of the Mississippi River Basin Convening April 8, 1969, Davenport, Iowa. Chicago, Ill. Great Lakes Region. 66 p.

Abstract: On March 5, 1969, the Secretary of the Interior called a conference to consider the establishment of water quality standards applicable to the interstate waters subject to the jurisdiction of the State of Iowa. The report deals with the interstate waters of Iowa draining to the Mississippi River, including the Mississippi River.

Keywords: Iowa, Water quality, Pollution

FISH COMMISSIONER OF IOWA. 1874-1952. Biennial Repts. (Name changed to Fish and Game Warden, and to Director of Fish and Game, but reports number consecutively.)

Abstract: Reports which describe the rescue efforts on fish which are endangered by low river levels. A tabulation of the number of each species rescued is given. One method of rescue is to transfer the fish to main Iowa rivers.

Keywords: Fish, Iowa, Rescue

HARLAND, BARTHOLOMEW AND ASSOCIATES. 1974. Lock and Dam No. 26 (Replacement) Upper Mississippi River Basin. Mississippi River - Alton, Ill. Environmental Study. Prepared for U.S. Army Corps of Engineers, St. Louis District. Design Memorandum No. 8. Architectural Treatment and Site Development.

Abstract: The purpose of this study and report is to provide a plan for enhancing the environmental aspects of the proposed Lock and Dam No. 26. The facility will be a major attraction for tourists and for persons interested in engineering and navigation. These visitors should be properly accommodated. The increased pool area is a conveniently located resource for additional water-based recreation facilities which are needed in the metropolitan area. The appearance of the locks and dam should express their function directly and this straightforward appearance should be repeated in such auxiliary structures as the administration and maintenance building, the visitors center and recreation buildings. The complex should be related to, and coordinated with, the planning programs of local, state and federal agencies concerned with the affected area, and should reflect the anticipated number of visitors that will be attracted. Recreational areas should be so arranged that their ownership, development and operation may be transferred to appropriate state or local agencies. Finally, the plans should be as flexible as possible, allowing the maximum number of future options in relation to changes that cannot now be anticipated.

Keywords: Lock and Dam 26, Upper Mississippi River, Illinois, Survey

ILLINOIS POWER COMPANY. 1973. Clinton Power Station - Units 1 and 2. Environ. Rept. Vols. 1-4.

Abstract: This report files the required documents for the docketing of its application for a construction permit and utilization facility license. Included in the report are objectives of the proposed facility, description of the site and plant, and possible environmental effects.

Keywords: Research, Illinois

INDUSTRIAL BIO-TEST LABORATORIES, INC. 1970. O. E. Fancher, ed., Preoperational environmental monitoring (thermal) of the Mississippi River near Quad-Cities Station (July 1969 through June 1970). Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: The results of preoperational thermal monitoring near the proposed Quad-Cities Station from July 1969 through June 1970.

Keywords: Nuclear power, Thermal effluent, Water quality, Limnology

INDUSTRIAL BIO-TEST LABORATORIES, INC. 1971. O. E. Fancher, ed., Preoperational environmental monitoring (thermal) of the Mississippi River near Quad-Cities Station (July 1970 through December 1970). Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: The results of preoperational thermal monitoring near the proposed Quad-Cities Station from July 1970 through December 1970.

Keywords: Nuclear power, Thermal effluent, Water quality, Limnology

INDUSTRIAL BIO-TEST LABORATORIES, INC. 1972a. M. P. Locke, ed., Determination of thermal effects in the Mississippi River near Quad-Cities Station (April 1971 through December 1971). 3 Vol. Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: The results of preoperational thermal monitoring near the proposed Quad-Cities Station from April 1971 through December 1971.

Keywords: Nuclear power, Thermal effluent, Water quality, Limnology, Chemistry, Phytoplankton, Zooplankton, Periphyton, Benthos, Plankton

INDUSTRIAL BIO-TEST LABORATORIES, INC. 1972b. M. P. Locke, ed., Determination of the thermal effects in the Mississippi River near Quad-Cities Station (January 1972 through July 1972) 2 Vol. Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: The results of preoperational thermal monitoring near the proposed Quad-Cities Station from January 1972 through July 1972.

Keywords: Nuclear power, Thermal effluent, Water quality, Limnology, Chemistry, Benthos, Phytoplankton, Zooplankton, Periphyton

INDUSTRIAL BIO-TEST LABORATORIES, INC. 1972c. Determination of thermal effects in the Mississippi River near Quad-Cities Station (August-December 1971). Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: The results of preoperational thermal monitoring near the proposed Quad-Cities Station from August through December 1971.

Keywords: Nuclear power, Thermal effluent, Water quality, Limnology, Chemistry, Zooplankton, Phytoplankton, Benthos, Periphyton

INDUSTRIAL BIO-TEST LABORATORIES, INC. 1973a. M. P. Locke and H. O. Eiler, eds., Determinations of the thermal effects in the Mississippi River near Quad-Cities Station (August 1972 through January 1973). Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: The results of preoperational thermal monitoring near the proposed Quad-Cities Station from August 1972 through January 1973.

Keywords: Nuclear power, Thermal effluent, Water quality, Limnology, Chemistry, Benthos, Periphyton, Zooplankton, Phytoplankton

INDUSTRIAL BIO-TEST LABORATORIES, INC. 1973b. H. O. Eiler and J. J. Delfino, eds., Operational environmental monitoring in the Mississippi River near Quad-Cities Station (February 1973 through July 1973). Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: This semi-annual report describes the results of environmental monitoring programs during the operation of the Station's diffuser pipe discharge system.

Keywords: Chemistry, Water quality, Fish, Life history, Plankton, Zooplankton, Nuclear power, Thermal effluent, Discharge, Phytoplankton, Benthos, Periphyton

INDUSTRIAL BIO-TEST LABORATORIES, INC. 1974a. H. O. Eiler and J. J. Delfino, eds., Operational environmental monitoring in the Mississippi River near Quad-Cities Station (August 1973 through January 1974). Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: Studies to determine the environmental characteristics of the Mississippi River in the vicinity of the Quad-Cities Station have been conducted since 1968. This study includes operational surveys designed to determine the environmental impact of condenser cooling water discharge into the River.

Keywords: Water quality, Chemistry, Fish, Periphyton, Phytoplankton, Zooplankton, Thermal effluent, Discharge, Habitat alteration, Benthos

INDUSTRIAL BIO-TEST LABORATORIES, INC. 1974b. R. P. Markel, ed. Operational environmental monitoring in the Mississippi River near Quad-Cities Station (February 1974 through July 1974). Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: This semi-annual report describes studies to determine the environmental characteristics of the Mississippi River in the vicinity of the Quad-Cities Station. The study includes operational surveys designed to determine the environmental impact of condenser cooling water discharge into the River.

Keywords: Water quality, Chemistry, Fish, Periphyton, Phytoplankton, Zooplankton, Thermal effluent, Discharge, Benthos

INDUSTRIAL BIO-TEST LABORATORIES, INC. 1975a. R. M. Gerhold, ed., Operational environmental monitoring in the Mississippi River near Quad-Cities Station, NRC Report (August 1974 through January 1975). Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: This semi-annual report describes studies to determine the environmental characteristics of the Mississippi River in the vicinity of the Quad-Cities Station. The study includes operational surveys designed to determine the environmental impact of condenser cooling water discharge into the River.

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INDUSTRIAL BIO-TEST LABORATORIES, INC. 1975b. R. M. Gerhold, ed., Operational environmental monitoring in the Mississippi River near Quad-Cities Station, NRC report (February 1975 through July 1975). Prepared for Commonwealth Edison, Co., Chicago, Ill.

Abstract: This semi-annual report describes studies to determine the environmental characteristics of the Mississippi River in the vicinity of the Quad-Cities Station. The study includes operational surveys designed to determine the environmental impact of condenser cooling water discharge into the River.

Keywords: Water quality, Chemistry, Fish, Periphyton, Phytoplankton, Zooplankton, Thermal effluent, Discharge, Habitat alteration, Benthos

INTER-AGENCY TASK FORCE ON PCB's. 1975. Preliminary report on the polychlorinated biphenyls in the Mississippi River and Lake Pepin.

Abstract: The task force was formed in May 1975 consisting of Minn. P. C. A., Minn. Dept. Health, Minn. D. N. R., Minn. D. Agric., Metropolitan Waste Control Commission, Wis. D. N. R., Wis. D. Agric., U. S. EPA (Minn. and Wis. District office), Fed. Food and Drug Admin. and U. S. Fish and Wildlife Service.

The highest levels of PCB (and the ones greater than 5 ppm) were found in fish fillets collected at the two Minnesota sampling locations. It was suggested that further, more detailed sampling should be initiated in that area. Generally, carp, catfish and white bass were found to have elevated concentrations of PCBs. Data collected also showed high correlation between percent fat content and PCBs levels.

Keywords: Chlorinated hydrocarbons, Fish, Lake Pepin, Minnesota

IOWA CONSERVATION COMMISSION. (undated). Guide to Mississippi River boating facilities. Ia. Conserv. Comm., Des Moines. 6 pp.

Abstract: A guide to recreational boating facilities on the Mississippi River with boat ramps, fees charged, and services provided described.

Keywords: Recreational boat traffic, Recreation

IOWA INSTITUTE OF HYDRAULIC RESEARCH. 1969. Effects of navigation-dam operating procedures on Mississippi River flood levels. U.S. Army Corps of Engs. Contr. No. DACW 23-69-C. 0024. 9 pp.

Abstract: The effects of navigation-dam operating procedures on flood levels in the reach of the Mississippi River between Dams 13 and 15, upstream from the Quad-Cities, is described. The results of a computational investigation show that the procedure established by the Corps of Engineers for operating the gates at the navigation dams causes no increase in the crest levels of large floods over that which would occur if the gates were completely opened well in advance of the flood.

Keywords: Flooding, Navigation

IOWA STATE HYGIENIC LABORATORY. 1969a. Mississippi River Water Quality Survey Report - Keokuk, Iowa area. River miles 354.3-363.9. Submitted to the Iowa Water Pollution Control Commission. 35 p.

Abstract: The Iowa Water Pollution Control Act states that pollution must be proven prior to action by the Iowa Water Pollution Control Commission. Pollution is defined as a condition whereby intended downstream uses are adversely affected and pollution is measured against the officially adopted Iowa Water Quality Standards.

This report delineates chemical, bacteriological and biological conditions measured from October, 1969 through September, 1969, and is the fifth of a series of evaluations as outlined May 12, 1969, to the Commission.

Keywords: Iowa, Pollution, Survey, Water quality, Limnology

IOWA STATE HYGIENIC LABORATORY. 1970. Pesticide levels in fish from Iowa streams. Rept. No. 71-23.

Abstract: Several varieties of fish were tested to determine the levels of dieldrin and other pesticides in the edible portion of their flesh. Bottom feeders exhibited less dieldrin than predatory game fish. Larger catfish over the entire state have accumulated abnormally high dieldrin levels in the edible portion with the exceptions of the upper Mississippi, the northeast Iowa streams and the northern reaches of the interior streams.

Predator game fish show no evidence of pesticide concentrations approaching significance to date. Reduction of pesticide use to a minimum level consistent with farm product economics should be immediately instigated.

Keywords: Iowa, Fish, Pesticides

MIDWEST RESEARCH INST. 1976. Water Pollution Control Act of 1972, Environmental Impact Assessment, Upper Mississippi River Basin. Minneapolis, Minn. North Star Research Div. National Commission of Water Quality, Washington, D. C. 341 p.

Abstract: A comprehensive environmental impact assessment at the Mississippi-Minnesota-St. Croix confluence was undertaken as part of a national assessment of anticipated environmental impacts of theoretically achieving or not achieving the requirements and goals of the Federal Water Pollution control Act Amendments of 1972. Authors (1) characterized historical and existing environmental conditions and (2) projected biological, ecological and environmental change, impacts and benefits, assuming specific reductions in point source effluent loadings and resultant water quality within the site. This site assessment is one of 41 similar studies conducted for the Environmental Sciences sector of the National Commission on Water Quality.

Keywords: Water quality, Upper Mississippi River, Minnesota, Recreation

MILWAUKEE PUBLIC MUSEUM. 1960. Handbook of Wisconsin Fishes. Popular Science Handbook Series No. 8 83 pp.

Abstract: A detailed discussion of the anatomy of the various fishes found in Wisconsin waters is omitted, for there is little confusion in the fisherman's mind as to what is or is not a fish. Only those anatomic characters necessary to sight identification are included.

In the interests of scientific accuracy, color, the mainstay of most fishermen, has been eliminated wherever possible from the keys. As a concession to the fisherman, scientific terminology has been kept to a minimum, and the terms used are those of more common usage.

Where there are many subspecies that would require identification by an expert the species included have been restricted to those of most interest to the fisherman.

In a few instances introduced fishes, seemingly established, have been included.

Keywords: Fish, Wisconsin, Anatomy

MINNESOTA GAME AND FISH COMMISSIONERS. 1904-1910, 1913-14, 1922-24, 1931-34. Biennial Reports.

Abstract: Reports published by the Minnesota Game and Fish Commissioners which give results of fishing studies for those years. Creel censuses are given as well as information on the amount of time spent fishing.

Keywords: Game, Fish

MINNESOTA POLLUTION CONTROL AGENCY. 1975. PCB investigation of the Mississippi River and its tributaries water, bottom sediment and point sources. 23 pp.

Abstract: In May, 1975, events occurred which focused attention on the PCB pollution problem in the Upper Mississippi River. An interagency task force of federal, state and local agencies initiated an extensive sampling program in the Upper Mississippi River Basin. The PCB Task Force sampling program included surface water and bottom sediment sampling of the Mississippi River and its tributaries, sanitary landfill monitoring well water sampling, industrial effluent sampling, municipal wastewater treatment plant effluent and sludge sampling, and fish flesh sampling.

Keywords: Pollution, Pesticides, Sediment, Minnesota

MINNESOTA, UNIVERSITY OF. 1966. List of references and selected books bearing on water resources in Minnesota. Water Resources Research Center. Bull 4.

Abstract: A listing of publications which relate to water resources in Minnesota.

Keywords: Minnesota, Water quality

MINNESOTA, UNIVERSITY OF. 1973. Ninth Annual Report, Water Resources Research Center. 112 p.

Abstract: This is the Ninth in a series of annual reports covering the activities of the Water Resources Research Center, University of Minnesota. The report indicates the nature of the program conducted in the twelve months beginning July 1, 1972, and ending June 30, 1973, with funds provided by the Graduate School and the Office of Water Resources Research in connection with the Water Resources Research Act of 1964. The Center supported 18 research projects involving 19 faculty members. These research projects were concerned with: mathematical watershed system analysis, aquatic plants, eutrophic lakes, groundwater basin information, water river ecology, perception of water resources problems, financing of water resources development, water pollution and social factors, forest management, water resources policies, sub-surface irrigation, flood forecasting, water policy decisions, precipitation variations, and floods.

Keywords: Water quality, Minnesota, Aquatic plants, Hydrology, Pollution, Flood, Vegetation

MINNESOTA-WISCONSIN PCB INTERAGENCY TASK FORCE. 1975. Preliminary report on the polychlorinated biphenyls in the Mississippi River and Lake Pepin. *Minn. Poll. Cont. Agency* and Wis. Dept. Nat. Res. joint pub. 13 pp.

Abstract: PCBs were detected in water at low levels in the Rum River at its confluence with the Mississippi River, in the St. Croix River at Prescott, Wisconsin, and in the Mississippi river at the Lowry Street Bridge and at the lower end of Lake Pepin.

PCB levels in fish fillets vary with the species of fish and location from which they are captured.

Keywords: Wisconsin, Pesticides, Lake Pepin, Minnesota

MINNESOTA-WISCONSIN PCB INTERAGENCY TASK FORCE. 1976. Polychlorinated biphenyls (PCBs) in the Upper Mississippi River basin. Minn. Poll. Cont. Agency and Wis. Dept. Nat. Res. joint pub. 55 pp.

Abstract: The Task Force initiated a field sampling program on the Mississippi River and its tributaries which included surface water sampling, bottom sediment sampling, sanitary landfill monitoring well water sampling, in-

dustrial effluent sampling, municipal waterwater treatment plant effluent and sludge sampling, and fish flesh sampling. This report presents all data obtained by the Task Force (including the August, 1975 Task Force preliminary report and the November 12, 1975 MPCA PCB report), and the conclusions and recommendations of the Task Force based on those data.

Keywords: Pesticides, Minnesota, Wisconsin

MISSISSIPPI RIVER COMMISSION. 1940. The Mississippi River. Office of the President, Mississippi River Commission, Vicksburg, Miss. 38 p.

Abstract: A short historic description of the development of flood control and navigation on the Mississippi River.

Keywords: Flooding, Navigation, History

MISSISSIPPI RIVER COMMISSION AND U.S. ARMY CORPS OF ENGINEERS. 1973. Mississippi River navigation. Vicksburg, MS. 21 pp.

Abstract: A brochure on the history, navigation and development of the Mississippi River. Includes statistics on the geography of the river system, boating information and information of general interest.

Keywords: Navigation, History, Commercial boat traffic

MISSOURI DEPARTMENT OF CONSERVATION. 1970. Palatability of Three Species of Fish and Aroma of Water from Sites on the Mississippi River. Columbia, Mo. 6 p.

Abstract: Since commercial fishing on the Mississippi River has been declining, an attempt was made to assess the palatability of fish from selected sites above and below the entry of effluent from St. Louis. Also, the relationship between palatability of fish and aroma of water was studied.

Keywords: Fish, Water quality, Pollution, Fishing, Missouri, Habitat alteration

NALCO ENVIRONMENTAL SCIENCES. 1974-1975. Unpublished monthly progress reports to Wisconsin Power Service Corporation. Power plant site evaluation of the Grant County Site near Glen Haven, Wisconsin.

Abstract: Reports discussing the progress of the monitoring program of the Grant County Site near Glen Haven.

Keywords: Thermal effluent, Limnology, Survey, Plankton, Benthos

NALCO ENVIRONMENTAL SCIENCES. 1976a. R. M. Gerhold, ed., Operational environmental monitoring in the Mississippi River near Quad-Cities Station (February 1975 through January 1976). Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: This annual report describes studies to determine the environmental characteristics of the Mississippi River in the vicinity of the Quad-Cities Station. The study includes operational surveys designed to determine the environmental impact of condenser cooling water discharge into the River.

Keywords: Water quality, Chemistry, Fish, Periphyton, Phytoplankton, Zooplankton, Thermal effluent, Discharge, Benthos

NALCO ENVIRONMENTAL SCIENCES. 1976b. R. M. Gerhold, ed., Operational environmental monitoring in the Mississippi River near Quad-Cities Station, NRC report (August 1975 through January 1976).

Abstract: This semi-annual report describes studies to determine the environmental characteristics of the Mississippi River in the vicinity of the Quad-Cities Station. The study includes operational surveys designed to determine the environmental impact of condenser cooling water discharge into the River.

Keywords: Water quality, Chemistry, Fish, Periphyton, Phytoplankton, Zooplankton, Thermal effluent, Discharge, Benthos

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NALCO ENVIRONMENTAL SCIENCES. 1977a. R. M. Gerhold, ed., Operational environmental monitoring in the Mississippi River near Quad-Cities Station, NRC report, (August 1976 through January 1977). Prepared for Commonwealth Edison Co., Chicago, Ill.

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Keywords: Water quality, Chemistry, Fish, Periphyton, Phytoplankton, Zooplankton, Thermal effluent, Discharge, Benthos

NALCO ENVIRONMENTAL SCIENCES. 1977b. R. M. Gerhold, ed., Operational environmental monitoring in the Mississippi River near Quad-Cities Station (February 1976 through January 1977). Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: This annual report describes studies to determine the environmental characteristics of the Mississippi River in the vicinity of the Quad-Cities Station. The study includes operational surveys designed to determine the environmental impact of condenser cooling water discharge into the River.

Keywords: Water quality, Chemistry, Fish, Periphyton, Phytoplankton, Zooplankton, Thermal effluent, Discharge, Macrophyte, Benthos

NALCO ENVIRONMENTAL SCIENCES. 1977c. Operational environmental monitoring in the Mississippi River near Quad-Cities Station (February 1977 through July 1977). Prepared for Commonwealth Edison, Co., Chicago, Illinois.

Abstract: This semi-annual report describes studies to determine the environmental characteristics of the Mississippi River in the vicinity of the Quad-Cities Station. The study includes operational surveys designed to determine the environmental impact of condenser cooling water discharge into the River.

Keywords: Water quality, Chemistry, Fish, Periphyton, Phytoplankton, Zooplankton, Thermal effluent, Discharge, Benthos

NALCO ENVIRONMENTAL SCIENCES. 1978. Operational environmental monitoring in the Mississippi River near Quad-Cities Station (August 1977 through January 1978). Prepared for Commonwealth Edison Co., Chicago, Ill.

Abstract: This semi-annual report describes studies to determine the environmental characteristics of the Mississippi River in the vicinity of the Quad-Cities Station. The study includes operational surveys designed to determine the environmental impact of condenser cooling water discharge into the River.

Keywords: Water quality, Chemistry, Fish, Periphyton, Phytoplankton, Thermal effluent, Discharge, Benthos

NATIONAL FIELD INVESTIGATIONS CENTER. 1970. Report on the Effect of the St. Louis Metropolitan Area on Water Quality in the Mississippi River, December 1969. Cincinnati, Ohio. 79 p.

Abstract: Contents: Description of River Reach; Phenol; Microbiology; Biology; Pesticides; Sediment chemistry; National Lead Company.

Keywords: Missouri, Water quality, Pesticides, Sediment, Pollution

NATIONAL RIFLE ASSOCIATION OF AMERICA REPORT. 1974. 97 p.

Abstract: The National Rifle Assn. provided $36,000 in research through its grant-in-aid program in 1974 to encourage advanced studies in the fields of wildlife and natural resources management, and in fields related to shooting sports and the lawful and safe use of firearms. Wildlife features in the National Rifle Assn's 1975 yearbook include discussions of: the future of Alaska's Caribou; the future of the great plains; the prairie boomer; a short history of federal legislation to conserve natural resources; the Mississippi flood and wildlife; stripmining in Pennsylvania; Kluane Nat'l Park in Alaska; management of white-tail deer and pheasants; the badlands of North Dakota; fire in Big Cypress Swamp; pacific coast wildlife; wasted energy in wildlife conservation; and the cosmopolitan wolf. Emphasis is on sport hunting, wildlife, and wildlife management.

Keywords: Hunting, Wildlife, Refuges, Migration, Birds, Research, Harvest, Management

NORTHERN STATES POWER COMPANY. 1969. Environmental monitoring program annual report, Monticello Nuclear Generating Plant. Monticello, MN.

Abstract: The second annual report of the pre-operationa monitoring program. The monitoring program is divided into two parts; radiation monitoring and ecological studies. The ecological survey studied macroinvertebrates, fish, water quality and algae.

Keywords: Minnesota, Survey, Nuclear power

NORTHERN STATES POWER COMPANY. 1970. Description of the environmental monitoring program for the Prairie Island Nuclear Generating Plant near Red Wing, Minnesota.

Abstract: The environmental monitoring program will provide two years pre-operational data. The study will determine existing ecological characteristics before thermal and radiological discharges occur, and assess any significant changes to the aquatic environment after operation.

Keywords: Minnesota, Nuclear power, Survey

NORTHERN STATES POWER COMPANY. 1972. Monticello Nuclear Generating Plant. Unit 1. Mississippi River Flow and Temperature Data. Minneapolis, Minn. 15 p.

Abstract: Tables presenting temperature and flow data for monitoring conducted near the Monticello Nuclear Generating Plant.

Keywords: Temperature, Minnesota, Flow, Nuclear power

NORTHERN STATES POWER COMPANY. 1973a. Monticello Nuclear Generating Plant. Unit 1. Environmental Monitoring and Ecological Studies Program. Annual Report 1972. Minneapolis, Minn. 576 p.

Abstract: This preoperational environmental monitoring work will be a base line upon which operational monitoring will be based. Studies were conducted in the areas of radiation and ecology such as water temperatures, water quality, macroinvertebrates, fish, and periphyton.

Keywords: Minnesota, Nuclear power, Ecology, Limnology, Water quality, Survey

NORTHERN STATES POWER COMPANY. 1973b. Prairie Island Nuclear Generating Plant. Units 1 and 2. Environmental Monitoring and Ecological Studies Program. Annual Report. 1972. Minneapolis, Minn. 754 p.

Abstract: This is the third Annual Report of the Environmental Monitoring and Ecological Studies Program for Prairie Island. The radiological and ecological effects of the plant on the environment will be described. Results showed no unusual levels of radiation on the parameters tested. Included in the ecological survey were studies on water chemistry, zooplankton, macroinvertebrates, fisheries, phytoplankton, periphyton, and terrestrial plants.

Keywords: Minnesota, Nuclear power, Ecology, Limnology, Water quality, Survey, Fish, Sediment, Thermal effluent

NORTHERN STATES POWER COMPANY. 1974. Monticello Nuclear Generating plant. Unit 1. Semiannual Operating Report No. 7, January - June 1974. Minneapolis, Minn. 118 p.

Abstract: Preoperational monitoring for Unit 1 which included radiation, water temperatures, water quality, macroinvertebrates, fish, and periphyton. This data will be used to compare against operational data.

Keywords: Water quality, Minnesota, Fish, Hydrology, Vegetation, Sediment, Chemistry

NORTH STAR RESEARCH INSTITUTE. 1973. Environmental Impact-assessment of the Northern Section of the Upper Mississippi River. Minneapolis. Prepared for St. Paul District of Engineers, 14 vol.

Abstract: The ecology and environmental impact of plant operation on the Upper Mississippi River wildlife and plants from the Upper St. Anthony Falls and down through Pool 10.

Keywords: Ecology, Habitat alteration, St. Anthony Falls, Pools 1-10

RYCHMAN, EDGERLEY, TOMLINSON AND ASSOCIATES, Inc. 1971. Report on Mississippi River temperature study for Commonwealth Edison Company, Chicago, Illinois.

Abstract: Hourly Mississippi River temperature data were obtained from Davenport and Keokuk, Iowa, for the period from January, 1957, through December, 1970. Also, river flow data was obtained for the same period at the Cordova, Illinois, site of the Quad Cities Nuclear Power Station. The resultant evaluation involved both the naturally occurring river temperatures and the simulated river temperatures from the superimposition of the power station's discharged heat load through a diffuser pipe when operating at 100 percent output capacity. The evaluation was performed on the basis of the natural and simulated temperature's compliance with the States of Iowa and Illinois thermal standards and proposed thermal standards, respectively.

Keywords: Temperature, Thermal effluents, Power

SPORT FISHING INSTITUTE. 1960. Mighty Mississippi fishing. Sport Fish. Inst., Bull. No. 107, October.

Abstract: The 1962-63 sport fishery of the Mississippi River, between St. Louis and Minneapolis, was surveyed by members of the Upper Mississippi River Conservation Committee. The survey, involving intensive catch sampling in 7 of the 25 navigational pools involved, was a cooperative effort by fishery biologists from Illinois, Iowa, Minnesota, Missouri, and Wisconsin. Walleyes are the most sought-after species.

Keywords: Fish, Sport fishing

TAFT SANITARY ENGINEERING CENTER. 1958. Pollution of Interstate Waters of the Mississippi River in the St. Louis Metropolitan Area. Cincinnati, Ohio. 32 p.

Abstract: The St. Louis Metropolitan Area surrounds the confluence of two of America's largest rivers, the Mississippi and the Missouri. The Mississippi is, in fact, so large at St. Louis, and downstream, that it has gained the reputation of being practically immune to damage by pollution. This reputation is not justified, as is shown by the report of the Bi-State Development Agency, Mississippi River Water Pollution Investigation, St. Louis Metropolitan Area, published in 1954 in cooperation with

the States of Illinois and Missouri and the U. S. Public Health Servie. The present report draws heavily on that excellent publication for basic data, facts, and conclusions. For the report data on sources of waste have been brought up to date and additional data including supplies, have been assembled. Additional computations, based on the 1951-52 data on bacterial contamination, oxygen demand, and dissolved oxygen both support and supplement the conclusions of the 1954 report.

Keywords: Missouri, Pollution, Water quality, Bacteria

TAFT SANITARY ENGINEERING CENTER. 1963. Report on Oil Spills Affecting the Minnesota and Mississippi Rivers, Winter of 1962-63. Cincinnati, Ohio. 51 p.

Abstract: Two separate oil spills occurred on the Minnesota River during the winter of 1962-63, one of petroleum oil and the second of soybean oil. During the spring ice break-up, these oils discharged to the Mississippi River at St. Paul, Minnesota and dispersed into several off-channel lakes between St. Paul, Minnesota, and Alma, Wisconsin, and resulted in the death of several thousand wild ducks. Some of the remedial activities included removal of oil from the water surface, construction of floating booms to divert oil from off-channel waters, and assistance in rescue of immobilized ducks and other wildlife. The object of this report is to present highlights of events and results of activities and studies conducted during the cleanup.

Keywords: Minnesota River, Petroleum, Pollution, Ducks

U.S. ARMY CORPS OF ENGINEERS. 1906. "1904 Snag and dredging boats, Upper Mississippi River." Annual Report

Abstract: Snag and dredging boats on the Upper Mississippi River, and improvements of the Mississippi River between the mouth of the Missouri River and the St. Paul and La Crosse harbors are discussed.

Keywords: Dredging, Commercial boat traffic, Upper Mississippi River

U.S. ARMY CORPS OF ENGINEERS. 1934. Model studies for channel stabilization, Mississippi River. Paper 15. U. S. Waterways Exp. Sta. Vicksburg, Miss.

Abstract: This paper presents results of model studies to the end of aiding in the solution of navigation problems at four points in the Mississippi River.

Keywords: Models, Navigation, Channelization

U.S. ARMY CORPS OF ENGINEERS. 1953. Investigation of Bituminous Cold Mixes for the Protection of Upper River Banks. Army Engineer Waterways Experiment Station Vicksburg, Miss. Mississippi River Commission, Vicksburg. 91 p.

Abstract: One of the current methods for protecting upper banks of the river and levee slopes includes the use of penetration-grade asphalt and river bar sand. Both materials must be heated before being blended into a hot sand-asphalt mix. The utility and satisfactoriness of the hot mix has been amply demonstrated during the past several years. A range of materials and mixtures was investigated in the laboratory tests and the more promising mixtures were studied in small-scale field tests.

Keywords: Flooding, Dike, Training structure, Hydrology

U.S. ARMY CORPS OF ENGINEERS. 1958. Navigation Charts. Middle and Upper Mississippi River. Cairo, Illinois to Minneapolis, Minn.

Abstract: A series of navigation charts of various sections of the Mississippi River with river depths and navigational markings.

Keywords: Navigation, Middle Mississippi River, Minnesota, Illinois, Upper Mississippi River

U.S. ARMY CORPS OF ENGINEERS. 1962. The Upper Mississippi River, Nine foot channel. Information Brochure.

Abstract: The nine-foot channel navigation project was started to make navigation possible between Minneapolis and St. Louis when the river drops 420 feet in 669 miles. The locks and dam "steps" eliminate shallow areas where boat traffic was limited.

Keywords: Upper Mississippi River, Channelization

U.S. ARMY CORPS OF ENGINEERS. 1963. Symposium on Channel Stabilization Problems. Committee on Channel Stabilization. 112 p.

Abstract: Contents: Stabilization problems, Lower Mississippi River; Bank stabilization and contraction problems in the South Atlantic division; Stabilization plan for the Arkansas River; Channel stabilization on the Missouri River; Channel stabilization practices on Middle Rio Grande in New Mexico; Channel stabilization, Columbia River; Research on channel stabilization.

Keywords: Channelization, Missouri River, Flooding, Dam, Dredging

U.S. ARMY CORPS OF ENGINEERS. 1964. Investigation of Underseepage and Its Control, Lower Mississippi River Levees. Appendix E: Analysis of 1961 Piezometric Data. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 62 p.

Abstract: In 1940 the Mississippi River Commission initiated a comprehensive study of underseepage and its control along the Lower Mississippi River levees. The purpose of this study was to provide data on the relation of soil conditions, geologic features, and underseepage and to improve methods for analyzing subsurface seepage. One phase of the investigation consisted of installation of piezometers at selected sites along the Lower Mississippi River to obtain data on the developmentof substratum hydrostatic pressures, and distances from the levee to the effective source of seepage entry. Analysis of piezometric data was based primarily on the 1950 high-water data.

Keywords: Lower Mississippi River, Flooding, Hydrology, Geology, Flow

U.S. ARMY CORPS OF ENGINEERS. 1966. Symposium on Channel Stabilization Problems. Committee on Channel Stabilization. 200 p.

Abstract: Contents: Channel stabilization work in the Vicksburg district; The stone-fill dike in the middle Mississippi River; Potamology studies, hydraulic analysis of Mississippi River channels; Bank stabilization, Red River below Denison Dam; Program of the Mississippi

River commission; Effectiveness of asphalt bank protection; River regulation works on the Apalachicola River; Planning, construction, and maintenance of the stabilization works on the Savannah River.

Keywords: Channelization, Navigation, Flooding, Dam, Dike

U.S. ARMY CORPS OF ENGINEERS. 1971a. Small-Boat Harbor, Mississippi River at Pepin, Wisconsin. Final environmental impact statement. Army Engineer District, St. Paul, Minn. 34 p.

Abstract: The project provides remedial works to adequately protect from wave damage an existing harbor on Lake Pepin at Pepin, Pepin County, Wisconsin. The harbor will then be more usable and easier to maintain. In addition, docking facilities can be expanded and improved without fear of further damage due to wave action. Construction will cause a temporary increase in turbidity which would have minimum impact on the water quality. No additional adverse impacts upon fish and wildlife resources will result from the project.

Keywords: Lake Pepin, Wisconsin, Water quality, Wave damage

U.S. ARMY CORPS OF ENGINEERS. 1971b. Wisconsin. Mississippi River at Prairie Du Chien. Evacuation and Management of the Flood Plain of Record at Prairie du Chien, Located on the Mississippi River in Crawford County. Office of the Chief of Engineers. Washington, D.C. 23 p.

Abstract: The proposed project would include the evacuation and management of the floodplain of record at Prairie du Chien, located on the Mississippi River in Crawford County, Wisconsin. If implemented, the project would revert a sparsely developed residential area back to open-spaced use complementing the original natural environment of the valley. With the project, the historic setting of the area could be fully restored and additional recreational facilities could be added, offering an even more inviting attraction for sportsmen, tourists, and historians. The project would eliminate during periods of high water the health hazard associated with water-filled basements, flooded septic tanks, and waterlogged furnishings. Evacuation of the floodplain would require relocation of 157 structures and purchase of another 48 structures. The proposed

project would result in no apparent adverse environmental effects. Vacant lands within the city limits would be committed to use as homesites for the relocated families. The project would make no irreversible or irretrievable commitment of any other resource.

Keywords: Wisconsin, Flooding, Recreation, Survey, Urbanization

U.S. ARMY CORPS OF ENGINEERS. 1971c. Navigation Project, Mississippi River, Fort Madison, Iowa. Commercial Boat Harbor, Fort Madison, Iowa. Final environmental impact statement. Army Engineer District, Rock Island, Ill. 27 p.

Abstract: The Fort Madison Commercial Harbor project is located in the city of Fort Madison, Lee County, Iowa. The project consists of dredging an access channel, with maneuvering area for barge traffic, from the 9-foot navigation channel of the Mississippi River to the Fort Madison industrial area. The proposed channel and maneuvering area will have a combined length of approximately 8,700 feet. A temporary increase in turbidity can be expected during construction and maintenance dredging and may result in a smothering effect on bottom organisms within the localized area. Disposal within the designated spoil areas will result in the loss of the existing natural environment. The physical loss of bottom organisms and creation of turbidity during construction and maintenance dredging are considered unavoidable adverse effects. Also, there will be the limited loss to recreational opportunities through the loss of fish and wildlife habitat and loss of scenic and aesthetic values resulting from canalization and spoiling within the designated areas.

Keywords: Navigation, Iowa, Commercial boat traffic, Survey, Dredging, Sedimentation, Fish, Recreation

U.S. ARMY CORPS OF ENGINEERS. 1972. Mississippi River Above Coon Rapids Dam, Days High Landing Dam, Minnesota. Draft environmental impact statement. Army Engineer District, St. Paul, Minn. 49 p.

Abstract: The proposed project provides for a low head stop-log dam across the Mississippi River at Days High Landing, Cass and Itasca Counties, Minnesota, to mitigate conservation losses, cause by past actions in the area. Environmental impacts are discussed.

Keywords: Minnesota, Dam, Survey, Wildlife, Vegetation, Habitat alteration

U.S. ARMY CORPS OF ENGINEERS. 1973a. Meredosia Levee and Drainage District, Illinois. Local Protection Project, Mississippi River. Draft environmental impact statement. Army Engineer District, Rock Island, Ill. 21 p.

Abstract: Proposed local flood protection is recommended for Meredosia Levee and Drainage District located in Rock Island and Whiteside Counties, Illinois, between miles 510.7 and 512.1 of the Mississippi River. Approximately 10,400 acres of agricultural land and 85 farmsteads will be protected from Mississippi River floods to a 100-year frequency by raising existing State Highway No. 84 along its present alignment. The project will be developed in cooperation with the Illinois Division of Highways and its plans for upgrading the highway to current safety standards. The project will be about 10,533 feet long, 19 feet high, and have a crown width of 44 feet. Additional features include hydraulic borrow, borrow for topsoil, raising of four existing road ramps, drainage structures, and modification to the pumping plant. The benefit-cost ratio for the proposed project is 3.4:1.0. Environmental impacts and adverse environmental effects are discussed.

Keywords: Illinois, Flooding, Vegetation, Benthos, Mitigation, Compensation, Habitat alteration

U.S. ARMY CORPS OF ENGINEERS. 1973b. Clinton, Iowa, Local Protection Project, Mississippi River. Draft environmental impact statement. Army Engineer District, Rock Island, Ill. 20 p.

Abstract: The project is located in Clinton County, Clinton, Iowa, and protects over 2,000 acres of commercial, residential, industrial, and park property within the city's corporate limits. The design includes an earth levee, floodwalls, closure structures, street ramps, interior drainage facilities and pumping stations to protect the city against flooding from the Mississippi River having a frequency of once in about 200 years. The General Design Memorandum has been completed, and the benefit/cost ratio for the proposed project is 3.5 to 1.0. The project will produce economic, psychological and social gains to the residents of the city. About 3,800 residences, 585 industrial and commercial businesses, and numerous schools and churches will

benefit from the project. The project will create a 'green belt' linking existing parks with pedestrian and bicycle paths and provide opportunities for dispersed recreation. The existence of the levee may impede accessibility to the river in some areas, as in Riverview Park.

Keywords: Iowa, Flooding, Urbanization, Recreation, Habitat alteration, Mitigation, Compensation

U.S. ARMY CORPS OF ENGINEERS. 1973c. Meremec Park Lake, Upper Mississippi River Basin, Meramec River, Missouri. Draft environmental empact statement. Army Engineer District, St. Louis, Mo. 598 p.

Abstract: The Meramec Park Lake will be located in Crawford County, Missouri with small portions in the abutting counties of Washington and Franklin. The impoundment will be formed by the construction of a dam on the Meramec River near the confluence of the Meramec and Mississippi Rivers. The dam site is about two miles east of the town of Sullivan, Missouri, and 65 road miles southwest of St. Louis. Environmental impacts include the inundation of wildlife habitat, conversion of stream habitat to lake habitat; flood protection to urban and rural areas; elimination of some stream recreation, on the reaches of the Meramec River and its tributaries inundated by the lake; increase of recreation below the dam; and relocation of cemeteries, roads, and utilites.

Keywords: Missouri, Upper Mississippi River, Dam, Habitat alteration, Vegetation, Flooding, Recreation, Mitigation, Compensation

U.S. ARMY CORPS OF ENGINEERS. 1973d. Meramec Park Lake, Upper Mississippi River Basin, Meramec River, Missouri. Appendix A through Appendix J. Draft environmental impact statement. Army Engineer District, St. Louis, Mo. 144 p.

Abstract: An appendix to the environmental impact statement draft for Meramec Park Lake on the Meramec River, Missouri, contains information on area flooding, earthquakes, water wells, soils, flora and fauna taxonomy, aquatic biota, wildlife, and aquaculture.

Keywords: Missouri, Upper Mississippi River, Dam, Vegetation, Flooding, Recreation, Habitat alteration

U.S. ARMY CORPS OF ENGINEERS. 1973e. Meramec Park Lake, Upper Mississippi River Basin, Meramec River, Missouri. Final environmental impact statement (Rev. and Suppl.) Army Engineer District, St. Louis, Mo. 425 p.

Abstract: The Meramec Park Lake will be located in Crawford County, Missouri, with small portions in the abutting counties of Washington and Franklin. The impoundment will be formed by the construction of a dam on the Meramec and Mississippi Rivers. The purposes of the lake are recreation, flood control, water quality, water supply, recreation, fish and wildlife, navigation and area redevelopment. The lake will have a normal pool of 12,600 acres. Environmental impacts include: Inundation of wildlife habitat: flood protection to urban and rural area; changes in land use; landscape diversity; long-term economic effect on the region. Adverse environmental effects include: Change in land use and the resultant effect on the agricultural sector of the economy; inundation of archeological sites; hardship on residents who are forced to relocate; downstream development as a result of project provided flood protection would cause increased pressure on the existing ecosystem.

Keywords: Missouri, Upper Mississippi River, Dam, Habitat alteration, Vegetation, Flooding, Recreation, Mitigation, Compensation

U.S. ARMY CORPS OF ENGINEERS. 1973f. Meramec Park Lake, Upper Mississippi River Basin, Meramec River, Missouri. Volume 2. Final environmental impact statement. Army Engineer District, St. Louis, Mo. 279 p.

Abstract: A number of public hearings and informational meetings were held regarding the plan for the development of the Meramec Basin. All of these included the construction of Meramec Park Lake prior to and following passage of the Flood Control Act of 1966 which modified the Meramec Park Lake project and included it in the overall plan for development of the basin. The public hearings are included in the report.

Keywords: Missouri, Upper Mississippi River, Dam, Vegetation, Flooding, Recreation, Habitat alteration, Mitigation

U.S. ARMY CORPS OF ENGINEERS. 1973g. Meramec Park Lake, Upper Mississippi River Basin, Meramec River, Missouri. Appendix M. Letters of Reply Received on the Draft

Environmental Statement. Final environmental impact statement Rev. and Suppl.). Army Engineer District, St. Louis, Mo. 173 p.

Abstract: The document contains the appendices as regards the flood history of the Meramec Basin.

Keywords: Flooding, Upper Mississippi River, Missouri, Water quality, Dam

U.S. ARMY CORPS OF ENGINEERS. 1973h. Pig's Eye Coal Terminal, Mississippi River at St. Paul, Ramsey County, Minnesota. Draft environmental impact statement. Army Engineer District, St. Paul, Minn. 220 p.

Abstract: The St. Paul Port Authority would construct a terminal to receive low-sulfur coal by unit train from Montana and to reship the coal to public utilities in the upper Mississippi River valley. The lower levels of sulfur dioxide emissions would decrease ambient levels of the pollutant and allow compliance with air quality standards. Direct economic benefits would accrue to the Port Authority, the construction contractors, the manufacturers of the terminal equipment, the coal-mining company, the Burlington Northern Railroad, barge interests, and their employees. Other economic benefits would include taxes paid to governmental units and the general stimulation of economic activity. Construction of the terminal would cause disturbance to, or loss of, more than 221 acres of terrestrial floodplain area, much of which is wooded.

Keywords: Minnesota, Commercial boat traffic, Water quality, Survey, Pollution, Habitat alteration

U.S. ARMY CORPS OF ENGINEERS. 1974a. Final Environmental Impact Statement, Pools 11 thru 22, Operations and Maintenance, Upper Mississippi River, 9-Foot Navigation Channel. U.S. Army Corps of Engineers, Rock Island, Illinois.

Abstract: The proposed action under consideration is the continued operation and maintenance of the nine-foot navigation channel in Pools 11 through 22 of the Upper Mississippi River.

The operation activities include the continued operation of the locks and dams to create stable pools. The maintenance activites involve upkeep of the fixed

man-made facilities, primarily the locks, dams, wing-dams and navigational aids. In addition, periodic dredging is necessary to maintain the navigation channel at a minimum depth of nine feet and to maintain eight small-boat harbors and three access channels at a minimum depth of five feet.

Keywords: Pools 11-22, Upper Mississippi River, Dredging, Navigation, Commercial boat traffic, Nine-foot channel, Habitat alteration

U.S. ARMY CORPS OF ENGINEERS. 1974b. Draft Environmental Statement, Davenport Local Flood Protection Project, Mississippi River, Davenport, Iowa. U.S. Army Corps of Engineers, Rock Island, Illinois.

Abstract: Construct earth levees and concrete floodwalls along the Mississippi River from Government Bridge downstream to Interstate 280 to provide flood protection for the Davenport portion of the Mississippi River floodplain and modify the Black Hawk Creek channel to provide flood protection for the Black Hawk Creek floodplain.

Keywords: Flooding, Iowa, Dredging, Spoil, Habitat alteration

U.S. ARMY CORPS OF ENGINEERS. 1974c. Final Environmental Statement, Clinton, Iowa, Local Protection Project. U.S. Army Corps of Engineers, Rock Island, Illinois.

Abstract: This project is located in Clinton County, Clinton, Iowa, and protects over 2,000 acres of commercial, residential, industrial, and park property within the city's corporate limits. The design includes an earth levee, floodwalls, closure structures, street ramps, interior drainage facilities and pumping stations to protect the city against flooding from the Mississippi River having a frequency of once in about 200 years. The project will produce economic, psychological, and social gains to the residents of the city.

Keywords: Iowa, Flooding, Recreation, Dredging, Habitat alteration

U.S. ARMY CORPS OF ENGINEERS. 1974d. Draft Environmental Statement, East Moline, Illinois, Flood Protection System, Mississippi and Rock Rivers. U.S. Army Corps of Engineers, Rock Island, Illinois.

Abstract: The recommended plan consists of constructing two levees, with a total length of 27,500 feet, designed to protect 2,750 acres within the project study area against Mississippi and Rock River Design floods (200-year frequency). Additional structures, ramps, closures, ponding areas, and pumping stations will be provided.

Keywords: Illinois, Rock River, Flooding, Habitat alteration

U.S. ARMY CORPS OF ENGINEERS. 1974e. Draft Environmental Impact Statement: Operation and maintenance Upper Mississippi River, Head of Navigation to Guttenberg Iowa. U.S. Army Corps of Engineers. St. Paul, MN.

Abstract: This environmental impact statement has been prepared in accordance with Section 102 of the National Environmental Policy Act of 1969 and the existing regulations and guidelines of the Corps of Engineers and the Council on Environmental Quality. The statement deals with the operation and maintenance of the 9-foot channel navigation system on the Upper Mississippi River within the St. Paul District. It includes the Mississippi River from the head of navigation to Guttenberg, Iowa, and the affected reaches of the lower St. Croix, Black, and Minnesota Rivers. The 9-foot channel project itself and past conditions are discussed only for purposes of establishing trends to evaluate the present and future impacts of the current method of operating and maintaining the navigation system.

Disciplines providing input to this statement include the following:

Biology	Economics
Civil Engineering	History
Water Resources Planning	Law
Wildlife Biology	Geology
Fishery Biology	Hydrology
Limnology	Hydraulics
Sociology	Sanitary Engineering
Soils Engineering	Marine Design Engineering
Recreation Planning	Plant Ecology

Keywords: Iowa, Minnesota, Upper Mississippi River, Navigation, Habitat alteration

U.S. ARMY CORPS OF ENGINEERS. 1975a. Final Environmental Statement, Fultin, Illinois and vicinity, Local Protection Project. U.S. Army Corps of Engineers, Rock Island, Illinois.

Abstract: The recommended plan consists of approximately 10 miles of new and improved levee designed to protect 9000+ acres within the project area from a Mississippi River flood of 200-year frequency.

Keywords: Illinois, Flooding, Habitat alteration, Wetlands, Levee

U.S. ARMY CORPS OF ENGINEERS. 1975b. Revised Draft Environmental Statement, Muscatine Island Levee District and Muscatine-Louisa County Drainage District No. 13, Iowa, Local Flood Protection. Office of the Chief of Engineers, Dept. of Army, Wash. D.C.

Abstract: The recommended plan consists of raising about 15 miles of existing levee to protect the project area against a Mississippi River standard project flood. Included in the plan are a new pumping station, a 3.8-mile drainage ditch, modification of an existing pumping station, two railroad closure structures, raising and resurfacing six road ramps over the levee, and landscaping and beautification measures. The purpose of the new pumping station and drainage ditch is to improve surface drainage in a 4,100-acre agricultural, residential, and industrial area.

Keywords: Iowa, Flooding, Habitat alteration

U.S. ARMY CORPS OF ENGINEERS. 1975c. Final Environmental Impact Statement, Milan-Big Island, Illinois, Local Flood Protection. U.S. Army Corps of Engineers, Rock Island, Illinois.

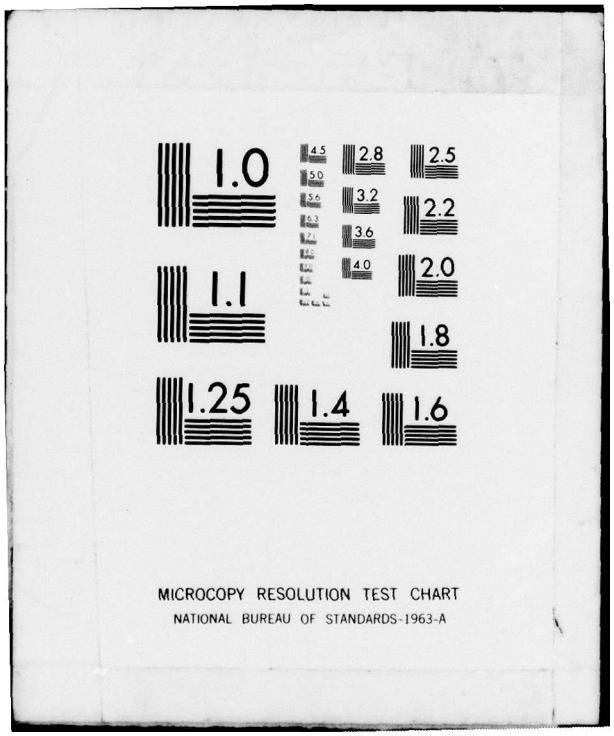
Abstract: Flood protection is to be provided to the Milan-Big Island area near the confluence of the Rock and Mississippi Rivers. The area will be protected from 200 year floods of the Rock and Mississippi Rivers, 200 year floods of Case, Kyte, and Eckhart Creeks, and from 100 year floods on Mill Creek. The project elements include levees along the south bank of Rock River, the west bank of Case Creek, the east bank of Kyte Creek and both banks of Mill and Eckhart Creeks. Three ponding areas are proposed to relieve interior drainage problems. The relocation of the existing outfall of

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the Milan sewage treatment plant from South Slough into the Rock River is incorporated in the plan to relieve an existing health hazard.

Keywords: Illinois, Flooding, Habitat alteration

U.S. ARMY CORPS OF ENGINEERS. 1977a. Environmental Harmony on the Mississippi River. Vol. 1. Rock Island District. Information Brochure. 4 p.

Abstract: The twelve navigation pools, resulting from development of the nine-foot channel, having provided outstanding water-oriented recreation. The pools provide an unexcelled "water playground" with vast open expanses of water, sheltered coves and sloughs, and many natural and man-made beaches. Land located along the Mississippi River has also provided recreational areas for camping and hiking.

Keywords: Nine-foot channel

U.S. ARMY CORPS OF ENGINEERS. 1977b. Mississippi River Recreation Areas. Information Brochure. Rock Island District.

Abstract: This brochure discusses the recreation areas managed by the Rock Island Corps of Engineers. Directions to get to each of the park areas is given with the facilities available at each facility.

Keywords: Recreation

U.S. ARMY CORPS OF ENGINEERS. Undated. Final Environmental Statement, Rock Island, Illinois, Mississippi River, Local Flood protection Project. U.S. Army Corps of Engineers, Rock Island, Illinois.

Abstract: This project is located in Rock Island County, Rock Island, Illinois. The project will protect 840 acres of urban flood plain comprised of residential, commercial and industrial developments. Features of the design include, but are not limited to, an earth levee, floodwall, floodwall with removable steel top section, access ramps, pumping stations and landscaping. The city will be protected against flooding from the Mississippi River having a frequency of once in about 200 years.

Recreation facilities including a bicycle-pedestrian path atop the levee, fisherman's access to the river, a neighborhood park, a scientific study area and extensive landscaping for screening and beautification are elements of this project. Project construction will alter or affect to some degree about three miles of river shoreline and aquatic habitat.

Keywords: Flooding, Illinois, Recreation, Habitat alteration

U.S. ARMY CORPS OF ENGINEERS. Undated. Final Environmental Statement, Evansdale, Iowa. Office of the Chief of Engineers, Dept. of Army, Wash. D.C.

Abstract: The Corps of Engineers has proposed to provide flood protection to the city of Evansdale by the construction of earthen levees. The protection project will utilize the embankment of a proposed freeway to serve as part of the total levee system. Inside the levees, eight ponding areas will be required to handle interior drainage. These ponding areas will encompass approximately 100 acres. Gravity drainage will be employed to handle interior runoff. Three borrow areas, totaling about 30 acres, will be required to furnish material for levee reaches 1 and 3. The protective works will be about 4.6 miles in length with a maximum height of 25 feet and an average height of 12 feet. Side slopes will vary from 1 foot vertical to 2.5 feet horizontal, to 1 foot vertical to 5 feet horizontal. Average base width will be 100 feet.

Keywords: Iowa, Flooding, Habitat alteration

U.S. ATOMIC ENERGY COMMISSION. 1971. Proposed Issuance of an Operating License to the Commonwealth Edison Company and the Iowa-Illinois Gas and Electric Company for the Quad-Cities Nuclear Power Station Units 1 and 2. Docket 50-254 and Docket 50-265. Final Environmental impact statement. Washington D.C. 109 p.

Abstract: The report concerns the licensing of the Commonwealth Edison Company and the Iowa-Illinois Gas and Electric Company to operate nuclear power reactors at a site located about 20 miles northeast of the Quad-Cities (Davenport, Iowa; Rock Island, Moline and East Moline, Illinois). The 404-acre site for the Station is on the east bank of the Mississippi River at Mile 509 above the Ohio River opposite the mouth of the Wapsipinicon River in Rock Island County, Illinois.

The nuclear power plant will utilize two boiling-water reactors and turbine generators. The principal environmental effects that have been associated with nuclear power facilities are potential radiological effects and the thermal effects of the heated condenser cooling water discharge. Small amounts of gaseous and liquid radioactive wastes will be released to the atmosphere and the Mississippi River at low concentrations. The radioactivity that may be released will be as low as practicable and in accordance with the Commission's regulations. The radioactive materials released to the atmosphere include the fission product noble gases krypton and xenon, activated argon and nitrogen, halogens (mostly iodines) and particulate material. The cooling water's release into the Mississippi has caused some problems in that state standards cannot be met. At present the applicants propose a spray diffusion system. This system, however, will not be adequate for low river flows.

Keywords: Nuclear power, Survey, Water quality, Thermal effluent, Pollution

U.S. COAST GUARD. 1971. Test Project 721314. Small Scale Explosive Icebreaker, Muskegon, Michigan. Draft environmental impact statement. Washington, D.C. 8 p.

Abstract: The project is concerned with utilization of an explosive underwater ice breaking method in the Great Lakes and Upper Mississippi River for the primary purpose of clearing sea lines in winter. Adverse impact effects anticipated include the possible effects of the explosions on marine life, noise levels on inhabitants, and gas discharges from the explosions.

Keywords: Upper Mississippi River, Commercial boat traffic, Water quality, Pollution, Survey, Hydrology, Fish, Ice

U.S. CONGRESS. HOUSE. AGRICULTURE COMMITTEE. 1924a. Mississippi River wild life and fish refuge. Hearings before the House Agriculture Committee on H.R. 4008, 11, 12, and 13 February 1924. 68th Cong., 1st Sess.

Abstract: Transcript of the discussion to establish the Upper Mississippi River Wildlife and Fish Refuge between Rock Island, Illinois and Wabasha, Minnesota.

Keywords: Legislation, Upper Mississippi River Wildlife & Fish Refuge

U.S. CONGRESS. HOUSE. RIVERS AND HARBORS COMMITTEE. 1924b. Mississippi, Missouri, and Ohio Rivers. Hearings on H.R. 3921, for improvement and completion of prescribed sections of Mississippi, Missouri, and Ohio Rivers, 20 March - 4 April 1924. 69th Cong., 1st Sess.

Abstract: A discussion of past bills and projects on the Mississippi River which were started and never finished. This bill states that there is a limitation of five years to complete the unfinished work.

Keywords: Legislation

U.S. CONGRESS. HOUSE. AGRICULTURE COMMITTEE. 1924c. Upper Mississippi River wild life and fish refuge. House Rept. 747, 68th Cong., 1st Sess. (8229).

Abstract: Discussion by the House on the establishment of the Upper Mississippi River Wildlife and Fish Refuge.

Keywords: Legislation, Upper Mississippi River Wildlife and Fish Refuge

U.S. CONGRESS. SENATE. COMMERCE COMMITTEE. 1924d. Upper Mississippi River wild life and fish refuge. Hearings before the Senate Committee on S. 1558, 15 February 1924. 68th Cong., 2nd Sess.

Abstract: A discussion by various authorities on the proposal to create the Upper Mississippi River Wildlife and Fish Refuge.

Keywords: Legislation, Upper Mississippi River Wildlife and Fish Refuge

U.S CONGRESS. HOUSE. AGRICULTURE COMMITTEE. 1925. Mississippi River wildlife and fish refuge. Hearings on H. J. Res. 320, 22 January 1925. 68th Cong., 2nd Sess.

Abstract: The second session of hearing on the bill to establish the Upper Mississippi River Wildlife and Fish Refuge.

Keywords: Legislation, Upper Mississippi River Wildlife and Fish Refuge

U.S. CONGRESS. HOUSE. RIVERS AND HARBORS COMMITTEE. 1930. Mississippi River, between mouth of Missouri River and Minneapolis, Minn. Document No. 290. (Interim Report). Let. from Sec. of War. 71st Cong., 2nd Sess. 50 pp.

Abstract: Hearings on the improvement of the Mississippi River between the mouth of the Missouri River and Minneapolis

Keywords: Legislation

U.S. CONGRESS. HOUSE. RIVERS AND HARBORS COMMITTEE. 1937. Mississippi River between the Missouri River and Minneapolis. Report on review of reports heretofore submitted on Mississippi River between the Missouri River and Minneapolis (damages by seepage and backwater than may be caused by construction on Locks and Dams and cost of making rectification thereof). Committee Doc. 34. 75th Cong., 1st Sess. H.R. 7563.

Abstract: The committee must decide on the question of reimbursement for seepage and flowage damages on the Mississippi River.

Keywords: Legislation

U.S CONGRESS. HOUSE. MERCHANT MARINE AND FISHERIES COMMITTEE. 1947. Promoting conservation of fish and wildlife resources of the Upper Mississippi River. Rept. 504, 80th Cong., 1st Sess. (11120)

Abstract: Session to provide assistance and to cooperate with federal, state and other suitable agencies, in promoting the conservation of wildlife by promoting sound land-use practices, and for other purposes.

Keywords: Legislation, Land use

U.S. DEPARTMENT OF THE INTERIOR. 1946. Water quality studies of the Mississippi River. Special Scientific Report #30. 77 pp.

Abstract: Samples were collected upstream of the Ohio River confluence to measure ammonia, total nitrogen, oxygen consumption, pH, specific conductance, carbonates, bicarbonates, carbon dioxide, turbidities and light penetration.

Keywords: Survey, Water quality

U.S. DEPARTMENT OF THE INTERIOR. 1948. A preliminary report on Fish and Wildlife Resources in relation to the Rock Island District Master Recreation Plan, Mississippi River, Wisconsin, Iowa, Missouri, Illinois. 8 p.

Abstract: The master plan is proposed for better access and public utilization of recreational sites bordering navigation pools 11-22 on the Mississippi River.

Keywords: Recreation, Pools 11-22, Illinois, Wisconsin, Missouri, Iowa

U.S. DEPARTMENT OF THE INTERIOR. 1964. Upper Mississippi River Wildlife and Fish Refuge. U.S. Department of the Interior, Fish and Wildlife Service. Refuge Leaflet 90-A.

Abstract: The Upper Mississippi River Wildlife and Fish Refuge was established in 1924 with the acreage coming from purchases, cession, and donation.

Today, the Upper Mississippi Refuge includes some 194,000 acres among the wooded islands, waters, and marshes extending 284 miles southward along the river bottoms from Wabasha, Minn., to Rock Island, Ill. This great river refuge demonstrates man's ability to preserve scenic, recreational, and wildlife resources amidst the needs of modern civilization.

Keywords: Upper Mississippi River Wildlife and Fish Refuge, Recreation

U.S. DEPARTMENT OF THE INTERIOR. 1968a. Upper Mississippi River Wildlife and Fish Refuge. Bureau of Sport Fisheries and Wildlife.

Abstract: Studies have shown that demand for recreational activities will increase in the future. The Upper Mississippi River Wildlife and Fish Refuge is ideal for contributing to recreational needs.

Keywords: Upper Mississippi River Wildlife and Fish Refuge, Recreation

U.S. DEPARTMENT OF THE INTERIOR. 1968b. Mammals of the Upper Mississippi River Wildlife and Fish Refuge. Bur. Sport Fish and Wildl. Leaflet. 326 p.

Keywords: Upper Mississippi River Wildlife and Fish Refuge, Mammals, Survey

U.S. DEPARTMENT OF THE INTERIOR. 1969a. Mississippi River Study. Report of Sampling from Dubuque to Bellevue, Iowa.

Abstract: A two-week study sampling seven transects on the Mississippi River. It was found that the Mississippi River was biologically degraded below the three Dubuque outfalls along the Iowa shore.

Keywords: Survey, Iowa, Ecology, Habitat alteration

U.S. DEPARTMENT OF INTERIOR. 1969b. Water Quality Standards Conference - State of Iowa. Iowa Interstate Waters of the Mississippi River Basin convening April 8, 1969, Davenport, Iowa. Federal Water Pollution Control Administration. Great Lakes Region, Chicago, Illinois. 54 p.

Abstract: The following interstate waters in Iowa which drain to the Mississippi River are discussed in this report:

The waters of the Mississippi River, Fox River, Des Moines River, East Fork of the Des Moines River, West Fork of the Des Moines River, Iowa River, Cedar River, Shellrock River, Winnebago River, Wapsipinicon River, and Upper Iowa River.

The following items were considered and standards recommended:

1. The treatment requirements and implementation plan for waste dischargers to the Mississippi and Missouri Rivers.

2. The requirements for disinfection of controlable waste discharges which may be sources of bacteriological pollution.

3. The temperature requirement for the interstate waters of the State of Iowa other than the Missouri and Mississippi Rivers.

4. A standard governing the maximum permissible levels of phenol.

5. A standard governing the maximum permissible levels of radioactivity.

6. A statement of policy with regard to the protection or existing high quality waters.

Keywords: Water quality, Pollution, Wapsipinicon River, Fox River, Iowa River

U.S. DEPARTMENT OF THE INTERIOR. 1972. Waterfowl status report. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife. Special Scientific Report. Wildlife No. 166. 146 pp.

Abstract: Information from surveys of the breeding and wintering grounds of waterfowl coupled with data from mail surveys of hunters play a major role in the development of annual hunting regulations for waterfowl. This report presents tabulations of the 1972 waterfowl population and habitat surveys and the results of mail surveys of waterfowl hunters for the 1971-72 season.

Keywords: Waterfowl, Survey

U.S. DEPARTMENT OF THE INTERIOR. 1974. Upper Mississippi River Wildlife and Fish Refuge, Iowa, Illinois, Minnesota and Wisconsin.

Abstract: A description of the Upper Mississippi River Wildlife and fish Refuges of the above four states.

Keywords: Upper Mississippi River Wildlife and Fish Refuge, Iowa, Illinois, Minnesota, Wisconsin

U.S. DEPARTMENT OF THE INTERIOR. 1975. Endangered and threatened wildlife and plants. Fed. Reg. 40:58308-58312.

Abstract: A proposal determination of critical habitat for snail darter, American crocodile, whooping crane, California condor, Indian bat, and Florida manatee.

Keywords: Vegetation, Threatened species, Endangered species, Wildlife

U.S. DEPARTMENT OF THE INTERIOR. 1976a. Migratory Birds- proposed revision of list. Fed. Reg. 41:50010-50014.

Abstract: This proposal would revise the list of migratory birds protected under the Migratory Bird Treaty Act. This revision will bring the list up to date by including those birds covered by the Treaty with Japan, and will also change the format of the list.

Keywords: Birds, Waterfowl, Migration, Species list

U.S. DEPARTMENT OF THE INTERIOR. 1976b. Endangered and threatened wildlife and plants. Fed. Reg. 41:47108-47198.

Abstract: A republication of the List of Endangered and Threatened Wildlife and Plants with errors that were detected in previous lists corrected.

Keywords: Vegetation, Threatened species, Endangered species, Wildlife

U.S. DEPARTMENT OF THE INTERIOR. 1976c. Agricultural runoff: A Bibliography. Office of Water Research and Technology Report. 286 p.

Abstract: Data on agricultural runoff contained in selected water resources abstracts are compiled in an extensive bibliography that includes abstracts, descriptors, and author indexes from the original document. Photolysis of ethylenethiourea, and chemical and biological characteristics of the Mississippi River are examples of some of the topics discussed.

Keywords: Hydrology

U.S. DEPARTMENT OF THE INTERIOR. 1977. Endangered and threatened wildlife and plants. Fed. Reg.

Abstract: The rule proposed will standardize the criteria for determining critical habitat and general rules for Federal agencies. The rule should also concern the conservation of this critical habitat.

Keywords: Threatened species, Endangered species, Vegetation, Wildlife

U.S DEPARTMENT OF TRANSPORTATION. 1975. Report: The replacement of Alton Locks and Dam 26. An advisory rept. to the Senate Commerce Comm. September.

Abstract: An evaluation of the economic implications of the Corps of Engineers' proposal to replace the current facility at Alton, Illinois with a new dam containing two 1200-foot locks. Conclusions stated that the expansion of Locks and Dam 26 would have an adverse effect on the financial condition of the areas railroads, and care should be taken so as to ensure that the government does not proceed with such an expansion unless it is economically warranted.

Keywords: Lock and Dam 26, Illinois

U.S. DEPARTMENT OF TRANSPORTATION. 1977. The Replacement of Alton Locks and Dam (Single 1200' Lock Proposal). Interim Report to Subcommittee on Water Resources of the Senate Public Works Committee. 46 p.

Abstract: As a matter of economics, there is no requirement for early action on a 1200-foot lock. Review of the traffic projections and of the capacity question leads to the conclusion that existing capacity will suffice at least until 1990. The whole questions of the desirable level of capacity on this waterway system should be the subject of a major and extensive study of the whole system. There is ample time in which to conduct such a study.

As a matter of engineering, the Corps of Engineers asserts that replacement or rehabilitation of the existing facility is required at this time. If this is indeed the case, it is very likely that a single 1200-foot lock would be constructed as part of such an effort at relatively low additional cost. If so, it would be economically desirable to construct such a 1200-foot lock since the capacity of the existing facility will almost certainly be reached in this century, and 1200 foot locks are already in place at the dams above and below Alton. There is considerable controversy surrounding the engineering aspects of this matter, however. Until these questions are satisfactorily resolved, DOT cannot submit a final report recommending an appropriate course of action. The Department will submit such a report as soon as we have satisfactory answers to the engineering questions.

Keywords: Lock and Dam 26, Illinois

U.S. FISH AND WILDLIFE SERVICE. 1976. Fish and wildlife technical report. Prep. for the Fish and Wildl. Task Group. Minneapolis - St. Paul Area Level B Study, UMRBC.

Abstract: The Twin Cities Level B Study featured public participation, which attempted to involve concerned citizens and groups. The Study was also oriented towards policy planning and judgement evaluation. Issues such as conservation and management of surface and ground-water supplies, water quality, flood damage, erosion and sediment control, and commercial navigation were studied.

Keywords: Fish, Wildlife

U.S. GEOLOGICAL SURVEY. 1953. Floods of 1950 in the Upper Mississippi River and Lake Superior basins in Minnesota. Water-Supply Paper 1137-G.

Abstract: This report contains records of stage and discharge at 46 gaging stations and records of storage or elevation at 6 reservoirs. A summary table shows crest stages and discharges at 72 points during the floods of April-June, and similar data are shown for former record floods where it is available. A discussion of concurrent meteorology and references to some outstanding past floods are also included.

Keywords: Minnesota, Flooding, Upper Mississippi River

U.S. GEOLOGICAL SURVEY. 1955a. Floods of 1952 in the basins of the Upper Mississippi River and Red River of the North. Water-Supply Paper 1260-C.

Abstract: The flood of April 1952 on the Mississippi River between the Minnesota and Des Moines Rivers established many record-high stages. In the Minnesota River Basin, the floods of April 1952 exceeded those of 1951 in many locations but generally were smaller than those of 1881. The timing of flows on the Mississippi and Minnesota Rivers was favorable for the highest possible peak flow at areas downstream from St. paul. Below the Wisconsin River, the 1951 and 1952 floods on the Mississippi River were of approximately equal size.

Keywords: Flooding, Upper Mississippi River

U.S. GEOLOGICAL SURVEY. 1955b. Surface water supply of the United States, Part 5, Hudson Bay and Upper Mississippi River basins. Water-Supply Paper 1901-1959.

Abstract: Records of chemical analysis, suspended sediment, and temperature for surface waters.

Keywords: Hydrology, Flood, Upper Mississippi River

U.S. GEOLOGICAL SURVEY. 1959. Compilation of records of surface waters of the United States through September 1950, Part 5, Hudson Bay and Upper Mississippi River basins. USGS Water Sup. Pap. 1308.

Abstract: This volume is one of a series of reports presenting monthly and yearly summaries of streamflow and reservoir data collected by the USGS. The reports summarize all the surface-water records collected up through September 1950.

Keywords: Hydrology

U.S. GEOLOGICAL SURVEY. 1966. Quality of surface waters of the United States, 1963, Parts 5 and 6, Hudson Bay and Upper Mississippi River basin, and Missouri River basin. Water-Supply Paper 1949.

Abstract: The records of chemical analysis, suspended sediment, and temperature for surface waters given in this volume serve as a basis for determining the suitability of the waters examined for all uses. The discharge of a stream and (to a lesser extent) the chemical quality are related to variations in rainfall and other forms of precipitation. In general, lower concentrations of dissolved solids may be expected during the periods of high flow than during periods of low flow. The concentration in some streams may change materially with relatively small variations in flow, whereas for other streams the quality may remain relatively uniform throughout large ranges in discharge. The quantities of suspended sediment carried by streams are also related to discharge, and during flood periods the sediment content in streams may vary over wide ranges.

Keywords: Water quality, Hydrology, Upper Mississippi River, Missouri River

U.S. GEOLOGICAL SURVEY. 1971a. Surface Water Supply of U.S. 1961-65. Part 5. Hudson Bay and Upper Mississippi River Basins. Volume 2. Upper Mississippi River Above Keokuk, Iowa. Water Supply Paper 1914

Abstract: This volume is one of a series of 37 reports presenting records of stage, discharge, and content, of streams, lakes, and reservoirs in the United States during the 1961-65 water years. Since 1888, when the U.S. Geological Survey first studied streamflow in relation to problems of irrigation, similar records have been obtained at more than 17,500 gaging stations in the 50 States. On September 30, 1965, the Geological Survey and cooperating organizations were maintaining 9,100 gaging stations. Partial-record stations for low flow or for floodflow have been operated at many other

points. The records for the 1961-65 water years at gaging stations and partial-record stations in the upper Mississippi River above Keokuk, Iowa, are given in this report.

Keywords: Hydrology, Flow, Flood

U.S. GEOLOGICAL SURVEY. 1971b. Quality of Surface Waters of U.S. 1966, Parts 5 and 6. Hudson Bay & Upper Mississippi River Basins, and Mississippi River Basin. Water Supply Paper 1993. 666 p.

Abstract: The records of chemical analysis, suspended sediment, and temperature of surface waters given in this volume serve as a basis for determining the suitability of waters for various uses. The flow and water quality of a stream are related to variations in rainfall and other forms of precipitation. In general, lower concentrations of dissolved solids may be expected during periods of high flow than during periods of low flow. Conversly, the suspended solids in some streams may change materially with relatively small variations in flow, whereas for other streams the quality of the water may remain relatively uniform throughout large ranges in discharge.

Keywords: Missouri River, Hydrology, Water quality

U.S. GEOLOGICAL SURVEY. 1971c. Water Resource Data for Kansas: Part 2. Water Quality Records. Vol. 2 140 p.

Abstract: Water resources data for the 1971 water year for Kansas include records of data for the chemical and physical characteristics of ground and surface waters. Data on the quality of surface water were collected from designated sampling sites at predetermined intervals, such as once daily, weekly, monthly, or less frequently. Records are given for 66 sampling stations of which nine are partial-record stations and 62 are miscellaneous sites. Records of chemical analyses are given for 46 groundwater sites. Records for pertinent water quality stations in bordering states are also included. (Numerous tables)

Keywords: Water quality, Hydrology, Missouri River, Sediment, Temperature, Chemistry

U.S. GEOLOGICAL SURVEY. 1973a. Water Resources Data for Missouri: Part 1. Surface Water Records: Part 2. Water Quality Records. 365 p.

Abstract: Water resource data for the 1973 water year for Missouri, including records of streamflow or reservoir storage at gauging stations, partial-record stations. And miscellaneous sites, and records of water quality data on the chemical and physical characteristics of surface water are given. In Part 1, records are included for 146 gauging stations, of which 139 are streamflow discharge stations, and seven are reservoir or lake stations; also included are records for 106 crest-stage partial record stations.

Keywords: Missouri, Hydrology, Water quality, Flow, Chemistry, Sediment, Temperature

U.S. GEOLOGICAL SURVEY. 1973b. Surface Water Supply of the United States 1966-70. Part 5. Hudson Bay and Upper Mississippi River Basins. Volume 3. Upper Mississippi River Basin Below Keokuk, Iowa. Water Supply Paper 2115. 612 p.

Abstract: This volume is one of a series of reports presenting monthly and yearly summaries of streamflow and reservoir data collected by the Geological Survey during the period October 1, 1950, to September 30, 1960. Included with these data are some records furnished by other Federal, State, and private agencies. This series of reports is a condensation of the detailed streamflow information presented in the annual series of reports known as "Surface Water Supply of the United States" for each of the years 1951 through 1960. The area covered by this report is the Hudson Bay and Upper Mississippi River basins.

Keywords: Water quality, Hydrology

U.S. GEOLOGICAL SURVEY AND CANADA DEPARTMENT OF ENVIRONMENT REPORT. 1975. Water Resources Review. 12 p.

Abstract: Streamflow and groundwater conditions in the U.S. and southern Canada are reviewed. Data are included for dissolved solids and water temperatures at downstream sites on six large rivers, usable contents of selected reservoirs near the end of the month, and flow of large rivers during October 1975. Groundwater resources for the Upper Mississippi region are appraised. Streamflow

decreased in parts of southern Canada and in some central and southern states and Alaska, but generally increased in central Canada, and in many eastern and western states and Hawaii.

Keywords: Flow, Hydrology, Temperature

U.S. PUBLIC HEALTH SERVICE. 1951a. Upper Mississippi Drainage Basin. A Cooperative State-Federal Report on Water Pollution. Chicago, Ill. Upper Mississippi and Great Lakes Drainage Basins Office. 99 p.

Abstract: The report presents information about the ways water resources are used, the pollution going into our water resources and the resulting damages, the benefits which may result from pollution prevention and abatement, the pollution prevention measures now in effect, and those required. There are two parts. Part one considers the water pollution problems of the basin as a whole. Part two presents briefly the data for each of the several sub-basins of the major basin, including a tabulation of pollution abatement projects now known to be needed for water pollution control.

Keywords: Pollution, Water quality

U.S. PUBLIC HEALTH SERVICE. 1951b. Upper Missouri River Drainage Basin. A Cooperative State-Federal Report on Water Pollution. Cincinnati, Ohio. Div. of Water Supply and Pollution Control. 52 p.

Abstract: The report is based on data available as of January 1, 1952, on sources of pollution, treatment facilities employed, and stream conditions for the Upper Mississippi River basin. It also presents information concerning use of water resources, pollution entering water resources and resulting damages, benefits which may result from pollution prevention and abatement, pollution prevention measures in effect and those which are needed.

Keywords: Upper Mississippi River, Pollution, Water quality

U.S. PUBLIC HEALTH SERVICE. 1952. A Report of Water Pollution in the Upper Missouri Drainage Basin. Cincinnati, Ohio. Div. of Water Supply and Pollution Control. 52 p.

Abstract: This report is based on data available as of January 1, 1952, on sources of pollution, treatment facilities employed, and stream conditions. The report also presents information concerning use of water resources, pollution entering water resources and resulting damages, benefits which may result from pollution prevention and abatement, pollution prevention measures in effect and those which are needed.

Keywords: Pollution, Water quality

U.S. PUBLIC HEALTH SERVICE. 1953a. Upper Portion Upper Mississippi River Drainage Basin. A Cooperative State-Federal Report on Water Pollution. Chicago, Ill. Upper Mississippi and Great Lakes Drainage Basins Office. 90 p.

Abstract: The report is based on data available as of January 1, 1953, on sources of pollution and treatment facilities employed, and on stream conditions revealed by field surveys made by the Minnesota Department of Health over a period extending from 1939 through 1952. The report also presents information concerning use of water resources, pollution entering water resources and resulting damages, and benefits which may result from pollution prevention and abatement. The report has been limited to known sources of pollution and their effects upon adjacent streams.

Keywords: Upper Mississippi River, Pollution, Water quality

U.S. PUBLIC HEALTH SERVICE. 1953b. A Comprehensive Water Pollution Control Program for the Mississippi-Des Moines-Skunk Rivers Basin Developed by the State Water Pollution Control Agencies of Illinois, Iowa, Minnesota, and Missouri. Cincinnati, Ohio. Div. of Water Supply and Pollution Control. 55 p.

Abstract: The report, prepared in cooperation with the water pollution control agencies of Iowa, Illinois, Minnesota and Missouri, sets forth the water pollution control program being followed by the respective States in the Mississippi-Des Moines-Skunk Rivers Basin. The program which is based on data available as of January 1, 1953, was developed after a thorough consideration of the existing and potential uses of the water resources in the basin; the pollution entering the streams and the resulting damages; the benefits which may result from pollution prevention and abatement; and the prevention measures now in effect as well as those which are needed.

Keywords: Pollution, Water quality, Illinois, Iowa, Minnesota, Missouri

U.S. PUBLIC HEALTH SERVICE. 1953c. A comprehensive Water Pollution Control Program for the Mississippi-Des Moines-Skunk Rivers Basin. Washington, D.C. 56 p.

Abstract: The report sets forth the water pollution control program being followed by the respective States in the Mississippi-Des Moines-Skunk Rivers basin. This program, which is based on data available as of January 1, 1953, was developed after a thorough consideration of the existing and potential uses of the water resources in the basin; the pollution entering the streams and the resulting damages; the benefits which may result from pollution prevention and abatement; and the prevention measures now in effect as well as those which are needed.

Keywords: Water quality, Pollution, Iowa, Illinois, Missouri, Minnesota

U.S. PUBLIC HEALTH SERVICES 1953d. A Comprehensive Program for Water Pollution Control for the Mississippi-Wapsipinicon and Tributaries Rivers Basin Developed by the State Water Pollution Control Agencies, of Illinois, Iowa, Minnesota, and Wisconsin. Cincinnati, Ohio. Div. of Water Supply and Pollution Control. 50 p.

Abstract: The report, prepared in cooperation with the water pollution control agencies of Iowa, Illinois, Minnesota, and Wisconsin, sets forth the water pollution control program being followed by the respective states in the Mississippi-Wapsipinicon and Tributaries River Basin. This program, which is based on data available as of July 1, 1953, was developed after a thorough consideration of the existing and potential uses of the water resources in the basin; the pollution entering the streams and the resulting damages; the benefits which may result from pollution prevention and abatement; and the prevention measures now in effect as well as which are needed.

Keywords: Water quality, Pollution, Iowa, Wapsipinicon River, Illinois, Minnesota, Wisconsin

U.S. PUBLIC HEALTH SERVICE. 1954a. A Comprehensive Water Pollution Control Program for the Mississippi-Salt Rivers Basin Developed by the State Water Pollution Control Agencies

of Illinois, Iowa, and Missouri. Cincinnati, Ohio. Div. of Water Supply and Pollution Control. 31 p.

Abstract: The report, prepared in cooperation with the water pollution control agencies of Iowa, Illinois, and Missouri, sets forth the water pollution control program being followed by the respective States in the Mississippi-Salt Rivers Basin. The program, which is based on data available as of January 1, 1954, was existing and potential uses of the water resources in the basin; the pollution entering the streams and the resulting damages; the benefits which may result from pollution prevention and abatement; and the prevention measures now in effect as well as those which are needed.

Keywords: Water quality, Pollution, Iowa, Salt River, Illinois, Wisconsin, Minnesota

U.S. PUBLIC HEALTH SERVICE. 1954b. Mississippi-Iowa-Cedar Rivers Basin: A Comprehensive Water Pollution Control Program. Public Health Service, Washington, D.C. 44 p.

Abstract: The report, prepared in cooperation with the water pollution control agencies of Iowa, Illinois, and Minnesota, sets forth the water pollution control program being followed by the respective States in the Mississippi-Iowa-Cedar Rivers Basin. This program, which is based on on data available as of July 1, 1953, was developed after a thorough consideration of the existing and potential uses of the water resources developed after a thorough consideration of the existing and potential uses of the water resources in the basin; the pollution entering the streams and the resulting damages; the benefits which may result from pollution prevention and abatement; and the prevention measures now in effect as well as those which are needed.

Keywords: Iowa River, Water quality, Pollution, Iowa, Illinois, Minnesota

U.S. PUBLIC HEALTH SERVICE. 1955. A Comprehensive Water Pollution Control Program for the Lower Portion Upper Mississippi River Basin Developed by the State Water Pollution Control Agencies of Iowa, Minnesota, and Wisconsin. Cincinnati, Ohio. Div. of Water Supply. 76 p.

Abstract: The report, prepared in cooperation with the water pollution control agencies of Iowa, Minnesota, and Wisconsin, sets forth the water pollution control pro-

gram being followed by the respective States in the Lower Portion Upper Mississippi River Basin. The program, which is based on data available as of November 1, 1954, was developed after a thorough consideration of the existing and potential uses of the water resources in the basin; the pollution entering the streams and lakes, and the resulting damages; the benefits which may result from pollution prevention and abatement; and the prevention measures now in effect as well as those which are needed.

Keywords: Iowa, Minnesota, Wisconsin, Water quality, Pollution, Upper Mississippi River

U.S. PUBLIC HEALTH SERVICE. 1958. Transcript of Conference - Pollution of Interstate Waters, Mississippi River, St. Louis Metropolitan Area - Held in St. Louis, Mo., 4 Mar 1958. Washington, D.C. 140 p.

Abstract: The purpose of the conference was to bring together the state and interstate water pollution control agencies, the localities concerned and industries and the Public Health Service to review the existing situation, the progress which has been made, and to lay a basis for future action by all parties concerned and to give the states and localities an opportunity to take any remedial action which may be indicated under state and local law.

Keywords: Missouri, Pollution, Water quality

U.S. PUBLIC HEALTH SERVICE. 1961. Review of Action Taken under the Enforcement Provisions of the Federal Water Pollution Control Act. Washington, D.C. Enforcement Branch. 26 p.

Abstract: Action taken under the enforcement provisions of the Federal Water Pollution Control Act is reviewed for the following areas: Animas River (Colorado-New Mexico), Bear River (Idaho-Utah-Wyoming), Big Blue River (Nebraska-Kansas), Colorado River and all tributaries, Lower Columbia River (Washington-Oregon), Corney Drainage System (Arkansas-Louisiana), North Fork of Holston River (Virginia-Tennessee), Mississippi River (St. Louis metropolitan area), Missouri River (Kansas City, Omaha, St. Joseph, and Sioux City metropolitan areas), North Platte River (Nebraska-Wyoming), Potomac River (Washington, D.C. Metropolitan area), and Raritan Bay (New Jersey-New York).

Keywords: Water quality, Pollution, Missouri River, Missouri

U.S. PUBLIC HEALTH SERVICE 1962. Transcript of Conference on Pollution of Interstate Waters of the Mississippi River, Iowa-Illinois, held in Clinton, Iowa, March 8, 1962. Chicago, Ill. Div. of Water Supply and Pollution Control. 141 p.

Abstract: This conference in the matter of pollution of the interstate waters of the Mississippi River, involving the States of Illinois and Iowa and the Department of Health, Education and Welfare, was held under the provisions of the Federal Water Pollution Control Act. The purpose of the conference is to bring together the State water pollution control agencies, the representatives of the United States Department of Health, Education and Welfare, and other interested parties to review the existing situation, the progress which has been made, and to lay a basis for future action by all parties concerned, and to give the states, localities, and industries an opportunity to take any remedial action which may be indicated under state and local law.

Keywords: Iowa, Illinois, Pollution

U.S. PUBLIC HEALTH SERVICE. 1963a. Water Pollution Surveillance System. Upper Mississippi River Basin. Washington D.C. Div. of Water Supply and Pollution Control. 121 p.

Abstract: The report presents water quality data for major river basins in the Upper Mississippi River Basin. The data was compiled from October 1, 1962 thru September 30, 1963 and covers radioactivity, plankton, organic chemicals, ammonia, chlorine demand, color, oxygen demand, temperature, minerals, turbidity, trace elements, coliform bacteria, and stream flow.

Keywords: Survey, Pollution, Upper Mississippi River, Water quality, Plankton, Chemistry

U.S. PUBLIC HEALTH SERVICE. 1963b. Water Resources Study Mississippi River Headwaters Reservoirs Minnesota. Kansas City, Mo. Region VI. 78 p.

Abstract: The report describes a study made to determine the present and prospective needs and values of storage in the existing headwaters reservoirs for municipal and

industrial water supply and water quality control from the Mississippi River Headwaters to the junction of the St. Croix River below the Minneapolis-St. Paul Standard Metropolitan Statistical Area. The scope of this investigation covers the base year (1965) and the 50-year projections (2015) of the requirements for M and I water supply and water quality control purposes.

Keywords: Minnesota, Reservoir, Water quality

U.S. PUBLIC HEALTH SERVICE. 1963c. Report on Oil Spills affecting the Minnesota and Mississippi Rivers, Winter of 1962-63. 40 pp.

Abstract: See Taft, Robert A., Sanitary Engineer Center 1963.

Keywords: Petroleum, Pollution, Minnesota River, Minnesota

U.S. PUBLIC HEALTH SERVICE. 1964a. Pollution of the Interstate Waters of the Upper Mississippi River. Conference Held at St. Paul, Minnesota on February 8, 1964. Volume I-VI. Washington, D.C. Div. of Water Supply and Pollution Control.

Abstract: The conference statements and discussions on the matter of pollution of interstate waters include information on: Water pollution control agencies; pollution sources; water supply; commercial fishing; swimming; waste sources and related information for Minnesota and Wisconsin.

Keywords: Upper Mississippi River, Pollution, Commercial fishing, Recreation, Minnesota, Wisconsin, Water quality

U.S. PUBLIC HEALTH SERVICE. 1964b. Fiscal Year 1964 Accomplishments and Fiscal Year 1965 Work Plans. Chicago, Ill. Div. of Water Supply and Pollution Contro. 65 p.

Abstract: The roles of Illinois, Indiana, Michigan, Ohio, and Wisconsin in a cooperative water pollution control program are reported. Topics covered in this paper include: why water pollution control is needed in this region: construction grants; water resources; International Joint Commission activities; Detroit River-Lake Erie Project; Twin Cities-Upper Mississippi River Basin Study; Ohio River Basin Project; enforcement; and organization.

Keywords: Illinois, Wisconsin, Pollution, Water quality, Upper Mississippi River

U.S. PUBLIC HEALTH SERVICE. 1965. Annual Report Fiscal Year 1965. Accomplishments During FY 1965. Work Plans for FY 1966. Chicago, Ill. Div. of Water Supply and Pollution Control. 61 p.

Abstract: Progress in controlling water pollution in Region V of HEW's Division of Water Supply and Pollution Control is reported for fiscal year 1965. Region V is a five state area bordered by the Great Lakes and the Mississippi and Ohio Rivers and their tributary streams. Accomplishments are reported for: the construction of sewage treatment facilities; the development and implementation of comprehensive programs for pollution abate ment in cooperation with the several states; abatement actions under the enforcement authority of the Federal Water Pollution Control Act; and technical assistance to Federal, state and local agencies in pollution abate ment problems. Work plans for the coming year are also summarized in this report.

Keywords: Water quality, Pollution, Wisconsin, Illinois, Ohio River

UPPER MISSISSIPPI RIVER COMPREHENSIVE BASIN STUDY. 1970a. Volume II. Appendix A: History of Investigations. Appendix B: Aesthetic and Cultural Values.

Abstract: The historical appendix documents the history, organization and procedures of the Upper Mississippi River Comprehensive Basin Study. The experience gained in this study can be applied to subsequent efforts to obtain overall integrated plans for the development, control and use of water and related land resources in the Basin. Appendix B maps the water resources of the Basin by geographic subdivisions identified by number and principal city.

Keywords: Upper Mississippi River, Survey, History, Recreation, Hydrology, Climatology, Navigation, Fish

UPPER MISSISSIPPI RIVER COMPREHENSIVE BASIN STUDY. 1970b. Volume III. Appendix C: Climatology and Meteorology. Appendix D: Surface Water Hydrology. Appendix E: Ground Water and Geology. Appendix F: Mineral Resources. Appendix

G: Fluvial Sediment. Coordinating Committee, Chicago, Ill. 310 p.

Abstract: A review is made of the earth resources of the basin which are important to the economy and environment of the area.

Keywords: Upper Mississippi River, Climatology, Hydrology, Geology, Sediment, Survey

UPPER MISSISSIPPI RIVER COMPREHENSIVE BASIN STUDY. 1970c. Volume IV. Appendix H: Water Supply and Quality control. Coordinating Committee, Chicago, Ill. 363 p.

Abstract: The document discusses water supply problems which occur where combined dependable surface and ground water resources are or will be insufficient to meet present or projected water supply needs. By 1980, water supply problems are expected to occur in six communities in the Basin. By the year 2000 an additional 13 problem areas will develop. Projections to 2020 indicate that there will be a total of 26 water supply problem areas developing in the Basin in the next 50 years. A second discussion concerns water quality control problems which exist where the design flow of a stream is insufficient to assimilate present and projected biochemical oxygen demand (BOD) waste discharges to a stream, assuming that secondary waste treatment is effected before discharge. Seventy-five major water quality control problems, resulting from municipal and industrial waste discharges, exist in the Upper Mississippi River Basin at present. It is expected that 24 more water quality control problems will have developed by 2020.

Keywords: Water quality, Upper Mississippi River, Hydrology, Minnesota, Wisconsin, Illinos, Iowa, Survey

UPPER MISSISSIPPI RIVER COMPREHENSIVE BASIN STUDY. 1970d. Volume V. Appendix I: Flood Control. Appendix J: Navigation Coordinating Committee, Chicago, Ill. 369 p.

Abstract: The analysis of floods, flood damage and criteria for flood plain development and flood control programs is given for the Basin, based on an evaluation of geographic, hydrologic and economic factors of flood plain use and development, corresponding average annual flood damages and projections of increased flood plain value, technological research, and information essential to an action program for flood control. Waterborne commerce is directly related to the investments of private industry in terminal and transport equipment and the

improvement in the design and operation of the equipment. The commercial navigation needs in the Basin were determined by an analysis of existing and future waterborne commerce on the Upper Mississippi River System. Nine commodity groupings were used.

Keywords: Upper Mississippi River, Flooding, Navigation, Commercial boat traffic, Barges, Dam, Reservoir, Survey

UPPER MISSISSIPPI RIVER COMPREHENSIVE BASIN STUDY. 1970e. Volume VI. Appendix K: Recreation. Appendix L: Fish and Wildlife. Appendix M: Power. Appendix N: Agriculture. Coordinating Committee, Chicago, Ill. 555 p.

Abstract: A review is made of the water resources of the Upper Mississippi River basin as affecting the social, economic, and industrial life of the area.

Keywords: Upper Mississippi River, Recreation, Fish, Wildlife, Power, Agriculture, Ecology, Survey

UPPER MISSISSIPPI RIVER COMPREHENSIVE BASIN STUDY. 1970f. Volume VII. Appendix O: State and Federal Water Laws, Policies, and Programs. Coordinating Committee, Chicago, Ill. 561 p.

Abstract: The question explored is whether the present legal machinery is conducive to a maximum utilization of the technical capabilities available to meet the water problems, or whether it is an obstacle to curative and preventive action. The present legal machinery is described and suggested changes are offered.

Keywords: Upper Mississippi River, Survey

UPPER MISSISSIPPI RIVER COMPREHENSIVE BASIN STUDY. 1970g. Volume VIII. Appendix P: Economics Base Study and Projection. Coordinating Committee, Chicago, Ill. 212 p.

Abstract: The appendix has developed estimates of the growth of water dependent elements in the economy of the Upper Mississippi River Basin to provide measures of requirements for future water and related land resource developement. Trends and projections of economic and demographic changes are developed for the nation, multistate region, the Basin, economic subregions and plan areas.

Keywords: Upper Mississippi River, Survey

UPPER MISSISSIPPI RIVER COMPREHENSIVE BASIN STUDY. 1973. Water and Related Land Resources. Coordinating Committee, Chicago, Ill. 19 p.

Abstract: The report describes the action to approve and adopt a framework for a development program to be used as a guide for the future management and development of the Upper Mississippi River Basin's water and related land resources. The adopted development program will provide a balanced distribution of the basin's water supply to permit maintenance of economic activity necessary to improve the standard of living and the health and welfare of the people residing in the basin. Changes recommended in the historically projected land use patterns will further provide for outdoor recreation; fish and wildlife utilization; preservation of natural, cultural and historical features; and permit the production of food, fiber and services required to support and enhance the economic and social well-being of the basin and nation.

Keywords: Upper Mississippi River, Development, Minnesota, Wisconsin, Iowa, Illinois, Missouri, Recreation

UPPER MISSISSIPPI RIVER BASIN COMMISSION. 1972. Annual Report Water Resources Council, Washington, D. C. 13 p.

Abstract: The report covers the Commission's first year of operation and contains a summary of its activities.

Keywords: Upper Mississippi River, Development

UPPER MISSISSIPPI RIVER CONSERVATION COMMITTEE. 1960. The mighty Mississippi-recreational guide from the headwaters to St. Louis. Upper Mississippi River Conservation Committee brochure.

Abstract: A recreational guide to parks, camping, hiking, boating facilities, and fishing opportunities.

Keywords: Recreation, Missouri

UPPER MISSISSIPPI RIVER CONSERVATION COMMITTEE. 1970. Report to Upper Mississippi River Commercial Fisherman. U.S. Bur. Commercial Fisheries. Davenport, Ia. 15 p.

Abstract: The report is the result of a 1969 survey by the Upper Mississippi River Conservation Committee and the U.S. Bureau of Commercial Fisheries of the commercial fisheries on the Upper Mississippi River. The purpose of this report is to summarize the locations and catch by commercial fisherman to aid other commericial fisherman in the future years.

Keywords: Commercial fishing, Survey, Upper Mississippi River

WATER POLLUTION CONTROL ACT OF 1972. 1976. Environmental Impact Assessment. 341 p.

Abstract: Presented are a comprehensive water quality analysis and environmental impact assessment at the Mississippi-Minnesota-St. Croix confluence undertaken as part of a national assessment of anticipated environmental impacts of achieving or not achieving the requirements of the federal water pollution control act amendments of 1972. Historical and existing water quality and environmental conditions are examined. Anticipated biological, ecological, and environmental effects, impacts, and benefits from projected changes in water quality, assuming specific levels of wastewater treatment to point source effluents entering the study site, are described.

Keywords: Pollution, Water quality, Minnesota

WATER RESOURCES ENGINEERS, INC. 1975. Water Quality Analysis Upper Mississippi River Basin. Walnut Creek, Calif. National Commission on Water Quality, Washington, D.C. 115 p.

Abstract: A comprehensive water quality analysis at the Upper Mississippi River Basin was undertaken as part of a national assessment of anticipated environmental impacts of theoretically achieving or not achieving the requirements and goals of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500). Authors (1) characterized historical and existing water quality conditions and (2) projected resultant water quality within the site, assuming specific levels of wastewater treatment to point source effluents entering the study site. The assessment is one of 41 similar studies conducted for the Environmental Sciences sector of the Commission.

Keywords: Upper Mississippi River, Water quality, Pollution, Ecology, Bacteria, Iowa, Wisconsin, Minnesota

WATER RESOURCES REVIEW. 1976. Streamflow and ground water conditions. 12 p.

Abstract: Streamflow and groundwater conditions are tabulated for the northeast, southeast, western great lakes region, midcontinent, west, Alaska, and Hawaii. Data on dissolved solids and water temperatures for January 1976 at downstream sites on six large rivers, usable contents of selected reservoirs near the end of January 1976 are included. Analyses of meteorologic, streamflow, and sediment data are compiled from the 1973 Mississippi River Basin Flood. In January 1976 flooding occurred in Maryland, New York, Pennsylvania, and Vermont.

Keywords: Hydrology, Flow, Reservoir, Temperature

WATER RESOURCES REVIEW. 1977. Streamflow and Groundwater Conditions. 18 p.

Abstract: Serious drought conditions persisted in February 1977 in large areas of the U.S. Snowpack was far below normal throughout the western states. Some reservoirs were at a record low. Monthly mean discharge of the Mississippi River near Vicksburg, Miss., was 61% below the February median flow. Selected data for the Great Lakes, Great Salt Lake, and other hydrologic sites, dissolved solids and water temperatures for February 1977 at downstream sites on six large rivers, usable contents of selected reservoirs near the end of the month. Selected snow survey courses in northeastern U.S. and southeastern Canada, and flow of large rivers during February 1977 are reported. Groundwater resources in the Arkansas-white-red-region are summarized.

Keywords: Hydrology, Flow, Reservoir, Temperature